VOLUME TEN
STRUCTURE—ZYRIANS

THE BRITISH ENCYCLOPEDIA

IN TEN VOLUMES
ILLUSTRATED

THE BRITISH ENCYCLOPEDIA

ILLUSTRATED

With an Introduction by
CYRIL NORWOOD, M.A., D. Litt.,
Headmaster of Harrow

Prepared under the general editorship of J. M. Parrish, M.A. (Oxon.), John R. Crossland, F.R.G.S., and Angelo S. Rappoport, Ph.D., B. ès L., with the specialist assistance and contributions of over 100 experts

VOLUME
TEN

ODHAMS PRESS LIMITED
LONDON, W.C. 2

Copyright, 1933

Printed in Great Britain

KEY TO PRONUNCIATION

The method of marking pronunciations here employed is either (1) by marking the syllable on which the accent falls, or (2) by a simple system of transliteration, to which the following is the Key :

VOWELS

ā, as in *fate*, or in *bare*.

ä, as in *alms*, Fr. *âme*, Ger. *Bahn* = á of Indian names.

å, the same sound short or medium, as in Fr. *bal*, Ger. *Mann*.

a, as in *fat*.

ą, as in *fall*.

a, obscure, as in *rural*, similar to *u* in *but*, ė in *her* : common in Indian names.

ē, as in *me* = *i* in *machine*.

e, as in *met*.

ė, as in *her*.

ī, as in *pine*, or as *ei* in Ger. *mein*.

i, as in *pin*, also used for the short sound corresponding to ē, as in French and Italian words.

eu, a long sound as in Fr. *jeûne* = Ger. long *ö*, as in *Söhne*, *Göthe* (Goethe).

eu, corresponding sound short or medium, as in Fr. *peu* = Ger. *ö* short.

ō, as in *note*, *moan*.

o, as in *not*, *soft*—that is, short or medium.

ö, as in *move*, *two*.

ū, as in *tube*.

u, as in *tub* : similar to ė and also to *a*.

ų, as in *bull*.

ü, as in Sc. *abune* = Fr. *û* as in *dû*, Ger. *ü* long as in *grün*, *Bühne*.

ů, the corresponding short or medium sound, as in Fr. *but*, Ger. *Müller*.

oi, as in *oil*.

ou, as in *pound* ; or as *au* in Ger. *Haus*.

CONSONANTS

Of the *consonants*, **b, d, f, h, j, k, l, m, n, ng, p, sh, t, v, z,** always have their common English sounds, when used to transliterate foreign words. The letter **c** is not used by itself in re-writing for pronunciation, **s** or **k** being used instead. The only consonantal symbols, therefore, that require explanation are the following :

ch is always as in ri*ch*.

d, nearly as *th* in *th*is = Sp. *d* in Ma*d*ri*d*, etc.

g is always hard, as in *go*.

h represents the guttural in Scotch lo*ch*, Ger. na*ch*, also other similar gutturals.

ŋ, Fr. nasal *n* as in bo*n*.

r represents both English *r*, and *r* in foreign words, which is generally much more strongly trilled.

s, always as in *so*.

th, as *th* in *th*in.

th, as *th* in *th*is.

w always consonantal, as in *we*.

x = ks, which are used instead.

y always consonantal, as in *ye*a (Fr. *ligne* would be re-written lēny).

zh, as *s* in pleasure = Fr. *j*.

THE BRITISH ENCYCLOPEDIA

VOLUME X

STRUCTURES, THEORY OF. The study of the effects of the nature and distribution of loads upon simple forms or built-up frame structures. In practical constructions, the dimensions and properties of the materials used must be suitable to resist deformation. In designing a structure, the effects that may produce rupture must be studied before the sections of materials to be used are decided upon. Shearing and bending effects are studied, and their variation shown from section to section by diagrams from which the maximum values can be seen. The *shearing force* to be resisted at any section is the algebraic sum of all the vertical forces acting on the beam either to the right or left of the section. At any similar section the *bending moment* to be resisted is the algebraic sum of the moments, about that section, of the right or left series of forces. The reactions at the supports can be found by considering the structure as a loaded lever, or by the consideration that at the free end of a beam the total bending moment is zero. For any series of definite loads the bending moment diagram is a polygon. For a uniformly distributed load the line of moments is a parabolic curve.

The loads upon a structure may be fixed or rolling. Girders that are subjected to the passage of a fast moving load should be designed with a lower working stress than when carrying a fixed load. The combined bending moment diagram for the fixed and moving loads would be used in such a case in the discussion of the strength requirements. When the bending moments are determined, the maximum stress per unit area (f) can be found from $f = \frac{My}{I}$, where M is the maximum bending moment, y the distance of the extreme layer from the neutral axis, and I is the *moment of inertia*, which is the summation of the small areas into which the section can be divided, multiplied by the squares of their distances from the neutral axis. From the equation a suitable section for the loading is obtained. Every structure is maintained in a state of equilibrium by the various loads acting upon it, namely, its own weight, the external loads, and the reactions at the supports. Force diagrams are drawn (*see* STATICS, GRAPHIC) to determine the loading of the various components of the structure. From the stresses so found the suitability of the chosen sections is determined. The wind and snow loads may be either treated in separate diagrams or all the loads at any point may be combined and the resultants used for a combined diagram. *See* ELASTICITY; STRENGTH OF MATERIALS.

STRUENSEE, Johann Friedrich, Count. Danish political philosopher, born 1737, died 1772. As physician to Christian VII. of Denmark he became a court favourite, was appointed Minister of State (1771), gradually usurped all administrative powers, and caused his own elevation to the peerage.

From an impartial standpoint Struensee was one of the ablest constructive minds of eighteenth-century administration. He encouraged education, trade, and the freedom of the press, but was guilty of an improper liaison with Caroline Matilda, the queen (sister of George III. of England), and was opposed by a powerful national party under the Crown Prince, and the dowager queen. Under pressure, Christian signed the warrant for the impeachment of Struensee (1772), who was tried for conspiracy and beheaded.

STRUMA. The chief river of Eastern Macedonia, Balkans. It rises 20 miles south of Sofia, and is a torrent in its upper course. On the plains of Jumaia and Melnik, which are very productive, the Struma's

breadth is only 30 to 50 yards, and its depth 1½ to 3½ feet; it frequently overflows and changes its course. It enters the sea in the Gulf of Rendina (Orfani), forming first Lake Takhino (70 sq. miles). Length, 150 miles. The Struma (ancient *Strymon*) figured in the Salonika operations of the European War.

STRUMITSA. A town of Serbia, Yugoslavia, on the Strumitsa River. It was taken by the Greeks in the second Balkan War (1913), fell to the French in Oct., 1915 (European War), was evacuated, and was in Germano-Turkish hands until 26th Sept., 1918, when British troops re-entered.

STRUTT, Joseph. English antiquary, born at Chelmsford in 1749, died in 1892. In 1773 he published his *Regal and Ecclesiastical Antiquities from Edward the Confessor to Henry VIII.* (new edition, 1842), and shortly afterwards his *Horda Angel-Cynnan, or Manners, Customs, etc., of the English* (1774-6, 3 vols., with 157 plates). His other works include a *Chronicle of England* (2 vols., 1777-8); *Biographical Dictionary of Engravers* (2 vols., 1785-6); *Dresses and Habits of the People of England, etc.* (2 vols., 1796-9, with 142 plates; new edition, 1875); and *Sports and Pastimes of the People of England* (40 plates, 1801; new edition, with 140 plates, 1827). He left some manuscripts, from which were afterwards published his *Queenhoo-Hall*, a romance, concluded by Sir Walter Scott; *Ancient Times*, a drama; also *The Test of Guilt, or Traits of Ancient Superstition*, a dramatic tale.

STRUVE (strö'vė), **Friedrich Georg Wilhelm von.** German astronomer, born 1793, died 1864. In 1813 he entered the Dorpat observatory, and was appointed director in 1817. On the completion of the Russian observatory at Pulkova, near St. Petersburg, in 1839, he was nominated director and continued his researches on nebulæ and double stars. From 1816 to 1819 he was engaged on the triangulation of Livonia, and from 1830 to 1845 he was connected with the measurement of the arc of the meridian in the Baltic provinces, which was afterwards extended to the Arctic Ocean and the Danube.

STRY, or **STRYJ** (strē). A town of Poland, in Galicia, on the Stryj. Leather goods and watches are made. Pop. 27,500.

STRYCHNINE (strik'nīn; $C_{21}H_{22}N_2O_2$). An alkaloid existing in nux-vomica, St. Ignatius' beans, and in the seeds of various other plants of the genus Strychnos (q.v.). It may be prepared by exhausting the crushed ripe seeds with very dilute hydrochloric acid, concentrating, adding milk of lime, and exhausting the precipitate with boiling alcohol, from which the strychnine is deposited on cooling. It crystallises in the form of translucent trimetric prisms. It has an intensely bitter taste, and is very poisonous. One-eighth of a grain will kill a large dog; three-eighths of a grain produces violent spasms in man, and half a grain may be fatal.

Strychnine acts upon the central nervous system, and stimulates the sense organs. It acts like a bitter, improving the appetite, and it is much used as a gastric tonic in dyspepsia. It is also used in cases of surgical shock and heart-failure, large doses (up to $\frac{1}{15}$ grain) being injected hypodermically. In a case of strychnine poisoning, potassium permanganate may be given to render the drug inactive, and emetics or the stomach-pump should be used. *See* TOXICOLOGY.

Chemically, strychnine is a mono-acid tertiary base. It yields quinoline and indole when fused with potash, and carbazole when heated with zinc dust. It is soluble in chloroform (1 in 6) and in boiling alcohol (1 in 12), but is nearly insoluble in ether.

STRYCHNOS (strik'nos). A genus of plants, nat. ord. Loganiaceæ. It is composed of trees or shrubs which do not yield a milky juice, and have opposite, usually nerved leaves and corymbose flowers; some of the species are possessed of tendrils, and are climbing plants. They are found principally in the tropical parts of Asia and America. Among the species are *S. nux-vomica*, nux vomica, poison-nut, or ratsbane; *S. potatōrum*, or clearing-nut; *S. Ignatii*, or St. Ignatius' bean; *S. columbrīna*, or snakewood; *S. toxifĕra*, woorali or curare (q.v.), the poison-plant of Guiana.

STRYPA. A battle fought between the Russians and the Austro-Germanic allies from Sept. to Nov., 1915 (*see* EUROPEAN WAR). The Strypa is one of the main left-bank tributaries of the Dniester, and flows southward through the Podolian Plateau parallel to the Sereth (Siret), Zbrucz, and Zlota Lipa.

STUBBS, William. British historian and divine, born in 1825, died in 1901. He was educated at Ripon Grammar School, whence he proceeded to Oxford University, where he graduated and became a Fellow of Trinity College. In 1848 he was ordained, and became vicar of Navestock, Essex, in 1850. In

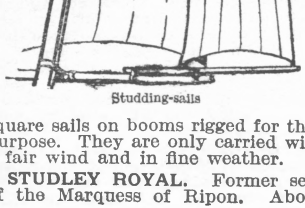
1862 he was appointed librarian of Lambeth Palace; in 1866 professor of modern history at Oxford; in 1869 curator of the Bodleian Library; in 1875 rector of Cholderton, Wilts; in 1879 canon residentiary of St. Paul's; in 1884 Bishop of Chester; and in 1888 Bishop of Oxford.

He edited many valuable historical works in the Rolls Series, including *Chronicles and Memorials of the reign of Richard I.* (1864-5), *Gesta Regis Henrici II.* (1867), *Chronicle of Roger Hoveden* (1872-3), *Memorials of St. Dunstan* (1874), and *Opera Radulphi de Diceto* (1876). His chief work is the *Constitutional History of England* (3 vols., 1874-8). He published many other works besides the above, and was a member of various English and foreign learned societies.

STUCCO (stuk'kō). A fine plaster, used as a coating for walls, and to give them a finished surface. Stucco for internal decorative purposes is a composition of very fine sand, pulverised marble, and gypsum, mixed with water till it is of a proper consistency. The stucco employed for external purposes is of a coarser kind, and variously prepared, the different sorts being generally distinguished by the name of cements. Some of these take a surface and polish almost equal to that of the finest marble. The third coat of three-coat plaster is termed stucco, consisting of fine lime and sand. There is a species called *bastard stucco*, in which a small portion of hair is used.

Stucco was used by the Greeks and by the Romans. It was employed in early Christian art, and became popular during the Renaissance.

STUDDING-SAILS. Formerly called *scudding-sails*, sails set outside the

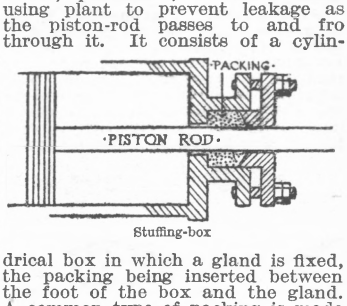


Studding-sails

square sails on booms rigged for that purpose. They are only carried with a fair wind and in fine weather.

STUDLEY ROYAL. Former seat of the Marquess of Ripon. About 2½ miles from Ripon, it is situated in a fine park which also contains Fountains Abbey. The grounds were laid out in the eighteenth century by John Aislabie, and include Dutch and Italian gardens.

STUFFING-BOX. The fitting which is inserted on the cylinder end of a steam, pneumatic, or other fluid-using plant to prevent leakage as the piston-rod passes to and fro through it. It consists of a cylin-



Stuffing-box

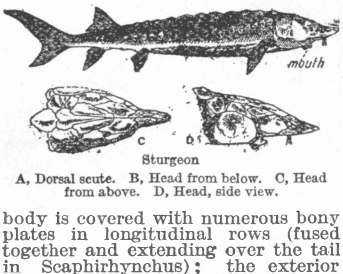
drical box in which a gland is fixed, the packing being inserted between the foot of the box and the gland. A common type of packing is made from hemp. With the advent of high pressures and temperatures the necessity for better types of packing materials has been emphasised and various types of metallic packings have been evolved. These are inserted in the same position as in the older arrangement, but are composed of shaped metallic pieces held together by an enveloping ring and pressed against the piston-rod by small springs. As these packings are usually self-adjusting and have very low frictional coefficients, their use has improved the over-all efficiency of the plant and caused considerable savings to be effected.

STUHLWEISSENBURG (stōl'vīs-ĕn-bu*r*h; Hung. *Székes Fejérvár*). A city of Hungary. It was the Roman *Alba Regia*, and was, for five centuries (1027-1527), the crowning- and burial-place of the Hungarian kings. It has a cathedral, built in 1752, a bishop's palace, and a theatre. Pop. 37,000.

STURDEE, Sir Frederick Charles Doveton, first Baronet (of the Falkland Islands). British admiral of the fleet, born 1859. He joined the navy in 1871, commanded the British force in Samoa (1899), was chief of staff Mediterranean Fleet (1905-7), chief of staff Channel Fleet (1907), A.D.C. (1907-8), and commanded the 2nd Cruiser Squadron (1912-3). He is best known, however, as the victor of the great sea-battle of the Falkland Islands (8th Dec., 1914) during the European War, when von Spee's squadron was

extirpated. At Jutland, Sturdee commanded the 4th Battle Cruiser Squadron and received the K.C.M.G. He received the K.C.B. in 1913, and in 1916 was created a baronet, becoming admiral in 1917 and admiral of the fleet in 1921. From 1918 to 1921 he was commander-in-chief at the Nore. He died in 1925.

STURGEON. The common name of ganoid fishes of the genera Acipenser and Scaphirhynchus, family Acipenseridæ, are all popularly included under the name sturgeon. The general form of the sturgeon is elongated and rather slender, the snout long and pointed in Acipenser, flat and paddle-shaped in Scaphirhynchus; the



Sturgeon

A, Dorsal scute. B, Head from below. C, Head from above. D, Head, side view.

body is covered with numerous bony plates in longitudinal rows (fused together and extending over the tail in Scaphirhynchus); the exterior portion of the head is also well mailed; the mouth, placed under the snout is small and funnel-shaped, without teeth, and provided with tentacle-like filaments or barbels. The eyes and nostrils are on the side of the head. On the back is a single dorsal fin, and the tail is forked, but is heterocercal or unequally lobed, and is provided with a row of spines along its upper margin.

Species. The species of Acipenser are sea-fish, but ascend large rivers in great abundance, and are the objects of important fisheries. The flesh of most of the species is wholesome and agreeable food; their roe is converted into caviare (*see* CAVIARE), and their air-bladder affords fine isinglass. The common sturgeon (*Acipenser sturio*) is found off the British coasts, in the North Sea, in the Mediterranean, and in most of the large rivers of Europe. Its flesh is firm and well-flavoured, somewhat resembling veal. The general body colour is yellow; its length is usually 5 or 6 to 8 feet, but it may reach 12 feet. The food consists of molluscs, small crustaceans, and small fishes. When caught in the Thames, within the jurisdiction of the Lord Mayor of London, it may be claimed by that dignitary; formerly it used to be regarded as a *royal* fish reserved for the sovereign.

The sterlet (*A. ruthēnus*) is found in the Volga and the Danube. Its flesh is the most delicate, and its roe yields the best caviare. The great or white sturgeon, or hausen (*A. huso*), is found in the Danube, the Volga, and other rivers running into the Black and Caspian Seas. It frequently exceeds 12 and 15 feet in length, and weighs up to 3200 lb. The flesh is not much esteemed, but the finest isinglass is made from its air-bladder. Other species are native to North America. The four species of Scaphirhynchus are known as shovel-nosed sturgeons, which are purely fluviatile. One of these (*S. platyrhynchus*) is North American; the others inhabit the rivers of Central Asia.

STURM, Jacques Charles François. French mathematician, born at Geneva 1803, died 1855. In 1829 he discovered a celebrated theorem (Sturm's Theorem) which allows the number of real roots of an equation between given limits to be determined with ease. In 1836 he succeeded Ampère as member of the Academy. From 1840 he was professor of mathematics at the Polytechnic School.

STURRY. Village of Kent. It is near Canterbury, 57¼ miles from London, on the Southern Rly. Here is a manor house, or court, dating from the sixteenth century, which is now the junior school of King's School, Canterbury. It was at one time the residence of Viscount Milner, whose widow presented it to the school. Pop. (1931), 1300.

STURT, Charles. Australian explorer, born 1795, died 1869. He entered the army, and in 1825 was stationed at Sidney, New South Wales, with the rank of captain. In 1828 he led an expedition to explore the interior of Australia, and discovered the Macquarie, Castlereagh, and Darling Rivers. He also explored the Murrumbidgee, and in 1830 discovered the Murray. In 1844 he penetrated to the great barren region nearly in the centre of the continent. He wrote *Two Expeditions into the Interior of South Australia in 1828-31*, and *Narrative of an Expedition into Central Australia in 1844-6*.

STUTTGART. Capital of the Republic of Württemberg, Germany, near the left bank of the Neckar. There are two old churches, and

the former royal library of 400,000 volumes; there is also a technical high school. Across the river is the town of Cannstatt. Stuttgart is the chief centre in South Germany for the book trade, connected with which are paper-mills, type-foundries, printing-presses, and lithographic establishments. The other leading manufactures include dyes, chemicals, woollen and cotton goods, various fancy articles, jewellery, musical instruments, mathematical and scientific instruments, liqueurs, confectionery, and beer. The city has a broadcasting station.

History. Stuttgart dates from 1229, and in 1320 became the residence of the Counts of Württemberg. From 1436 to 1482 it was much improved and enlarged, and has since, with only a short interval, been the capital. Stuttgart was bombed by Allied aircraft during the European War. Pop. (1925), 363,532.

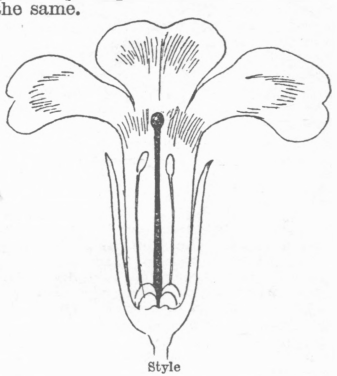
STUYVESANT (stī've-sant), **Peter.** Born in Holland in 1592, died in 1672. In 1646 he was appointed Director-General of the Dutch colony of the New Netherlands, a position he held until 1664, when the colony fell into the hands of the English and became known as New York. Stuyvesant went to Holland the next year, but soon returned, and passed the rest of his life at his farm called the Bouwerij, from which the present Bowery in the city of New York has its name.

STYE, or **HORDEOLUM.** A small abscess on the margin of the eyelid, due to suppuration in a hair follicle. During the early stages hot fomentations should be continuously applied, and whenever pus has formed the stye should be opened. Their frequent appearance is often associated with a poor general condition of the patient, and in such cases treatment should be given to improve this. In persistent cases inoculation with staphylococcus vaccine should be undertaken.

STYLE. In botany, the prolongation of the summit of the ovary which supports the stigma. Sometimes it is entirely wanting, and then the stigma is *sessile*, as in the poppy and tulip. When the ovary is composed of a single carpel, the style is also single, and the number of styles varies according to the number of carpels, though when the carpels are numerous the styles may be united. *See* FLOWER.

STYLIDIUM, or **CANDOLLEA.** A genus of gamopetalous dicotyledons, herbs, or undershrubs, natives chiefly of Australia.

S. adnatum, which is often grown in greenhouses, has a remarkable pollination mechanism. The floral axis is prolonged into a long, stalk-like column or gynostemium bearing the stigma at its upper end, and, just below it, two sessile anthers. Four lobes of the corolla are normally developed, but the fifth is reduced to a small cushion with a sticky surface. The column performs very active curvatures owing to lop-sided growth. When it comes in contact with the cushion, it is held fast by the sticky secretion for some time after it has started to bend away from it again, so that a state of tension is set up. At this stage a slight touch, e.g. by an insect, sets the column free, and it springs up forcibly, striking the visitor with the stigma and also dusting it with pollen. The action may be repeated several times. In other species the precise methods of temporarily arresting the column vary, though the general principle of the mechanism is the same.



Style

STYLITES (stī-līts), or **PILLAR SAINTS** (from the Gr. *stylos*, column; in Lat. *sancti columnares*). A class of Christian saints, who, by way of penance, passed the greater part of their lives on the top of high columns. This method of self-torture was introduced by Simeon the Stylite (St. Simeon Stylītēs), a Syrian monk, although Lucian (*De Dea Syria*, about A.D. 150) speaks of a high column at Hieropolis to the top of which a man ascended twice a year to converse with the gods.

Simeon the Stylite lived in the open air near Antioch, on the top of a column 40 cubits high and only 3 feet in diameter at the top. Here he remained for many years, till his death in 459 or 460. It appears,

however, that he must have descended at times, since he cured the sick by his touch, and performed sundry other miracles, wrote epistles, and took part in political quarrels. His example was imitated by many persons in Syria and Palestine, and the mania continued until the twelfth century.

STY'LOBATE. In architecture, generally, any sort of basement upon which columns are placed to raise them above the level of the ground or floor; but, technically, a continuous unbroken pedestal upon which an entire range of columns stands, contradistinguished from pedestals, which are merely detached fragments of a stylobate placed beneath each column.

STYP'TIC. A remedy that has the virtue of clotting blood, or of closing the aperture of a wounded vessel. Oak bark decoction, gall-nuts in powder or infusion, matico, and turpentine are styptics derived from the vegetable kingdom; and from the mineral are derived salts of iron, the sulphates of copper and zinc, the acetate of lead, the nitrate of silver, and alum. Among the most valuable of styptics are adrenalin (q.v.) and cotarnine, the latter of which is an oxidation product of the opium base narcotine.

STYR. Austro-German and Russian battles of the European War: (1) 28th Sept., 1915, to 17th Oct., 1915; (2) June-July, 1916.

STYRA'CEÆ, or **STYRACA'CÆ.** A small natural order of plants belonging to the polycarpous group of gamopetalous dicotyledons. The species are trees or shrubs with alternate leaves without stipules. The flowers are usually axillary, and are either solitary or clustered, with membranaceous bracts; the fruit is a drupe, the seeds few or solitary. The species are chiefly found in the temperate and tropical parts of North and South America, and also in Asia and Africa. The order is chiefly remarkable for furnishing the benzoin of commerce (see also STORAX). Some of the species are used for dyeing yellow. The order includes the snowdrop-tree of North America (*Halesia tetraptera*).

STYRAX (stī'raks). A genus of plants, nat. ord. Styraceæ, of which it is the type. The species are graceful trees and shrubs, with entire leaves and white or cream-coloured racemose flowers. They are principally natives of America and Asia; one is found in Europe, and one in Africa. *S. officinālis*, also called storax, is a native of Syria, Italy, and the Levant. It was the source of the storax of ancient times. *S. Benzoin* (gum-benjamin tree) is a native of Sumatra and Java. It yields the gum benzoin of commerce. (*See* BENZOIN.) The hardy species of Styrax are well adapted for shrubberies, on account of their foliage and handsome flowers.

STYRIA (Ger. *Steiermark*). A province of the Republic of Austria, formerly a duchy and crown-land. Area, 6323 sq. miles; pop. (1923), 978,845: former area, 8622 sq. miles; pop. (1910), 1,444,157. Under the imperial régime Styria had upper, middle, and lower (or southern) divisions, but Lower Styria, and a part of the middle division south of the Pozruck range and the Mur (roughly 2300 sq. miles), is incorporated in Yugoslavia. There are now sixteen administrative districts, plus Graz, the capital, which is autonomous. Other towns are: Bruck (pop. 8580), Mariazell (2000), Donawitz (15,100), Knittelfeld (11,000), Leoben (10,400), Kapfenberg (13,000), Eggenberg bei Graz (15,600), and Fürstenfeld (6000).

Products and Industries. The province lies within the Eastern Alps, and produces iron, coal (lignite, Leoben being the metropolis of the mining region), graphite, and salt (at Aussee), with some lead, zinc, copper, talc, manganese, etc. There are large iron-, steel-, and locomotive-works centring on Graz. Old Styria was the richest timber-land of the Dual Monarchy, larch, spruce, beech, oak, and elm being cut, and exported mainly via Trieste. Cattle-raising, apiculture, poultry, viticulture, market-gardening, and the raising of the heavy Norican horses of the Ennsthal are important industries.

Railways. Styria is served by the trunk-line of railways from Vienna to Trieste via Laibach (*see* SYSTEMS, RAILWAY, paragraph 6, section (*j*), *Trieste*). The line crosses the Semmering Pass, runs down the Mur Thal or valley to Kapfenberg, swings southwards to Graz, and runs past Spielfeld to Marburg (Yugoslavia). Bruck is the junction for Budapest (*see* SYSTEMS, RAILWAY, paragraph 13, section (*d*).

STYX. In Greek and Roman mythology, one of the rivers of the infernal regions. By this the gods swore when they wished to give peculiar sanctity to their oath. Styx was also the name of a rivulet in Arcadia, whose water was considered poisonous.

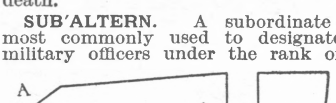
SUABIA, or **SWABIA** (Ger. *Schwaben*). An ancient duchy of Germany, originally Alemannia, the home of the Alemanni, but overrun by the Suevi,

and subsequently known as Suevia or Schwabenland. It existed as a duchy from the tenth to the middle of the thirteenth century, corresponding generally to Württemberg, Baden, parts of Bavaria, Liechtenstein, and Hohenzollern, and the union of its towns (1376) gave rise to the Suabian League. Modern Suabia is a division (*Regierungsbezirke*) of the Bavarian Republic. Area, 3807 sq. miles; pop. (1925), 859,397; capital, Augsburg.

SUÂ'KIN. A port of the Anglo-Egyptian Sudan, on the Red Sea. The main part of the town occupies a coralline island in the Red Sea, and the mainland portion (Al Kaf) is fortified. Pop. 10,000. *See* PORT SUDAN.

SUA'REZ, Francisco. Spanish theologian, born 1548, died 1617. Joining the Jesuits (1564), he was successively professor of theology at Valladolid, Rome, Alcalá, and Salamanca. Philip II. appointed him professor of divinity at Coimbra (1597), a position he held until his death.

SUB'ALTERN. A subordinate; most commonly used to designate military officers under the rank of



Subaltern—A, Shoulder strap. B, Sleeve

captain. In modern times the term subaltern officers denotes lieutenants and second-lieutenants, the latter being the present-day titles of the former cornets (of horse) and ensigns (of foot).

SUBCONSCIOUSNESS. A psychological term applied in a variety of ways by different psychologists. It principally means a fainter or obscurer degree of consciousness, dim and partial, which gradually gives way to a state of non-consciousness. There is a subconsciousness of impressions and a subconsciousness of ideas. The term is further applied to those activities of the mind which, lying below the level of clear consciousness, or being unaccompanied by consciousness, cannot be submitted to introspection. To such activities of the unconscious belong many of our unreasoned sentiments and unreflective movements, and also the cases witnessed in telepathy, somnambulism, clairvoyance, and hysteria, and many other psychical phenomena called abnormal. *See* PSYCHOTHERAPY AND PSYCHOANALYSIS.—BIBLIOGRAPHY: J. Ward, *Psychological Principles*; J. D. Angell, *Psychology*; J. Jastrow, *The Subconscious*; S. Freud, *The Psychopathology of Everyday Life*.

SUBIA'CO (ancient, **Sablaqueum**). A town of Italy, in the province of Rome, on the Anio, 1340 feet above sea-level. There are ironworks and paper-mills. Pop. 8215.

SUBLIMATION. The conversion of a solid directly into a vapour or gas when heated, and the conversion back into the solid on cooling, without, in either case, the intermediate formation of a liquid phase.

Sublimation bears the same relation to a solid that distillation does to a liquid. It is made use of for purifying substances, as in this way a volatile solid may be separated from a volatile one. The solid which is deposited as the vapour cools is termed the *sublimate*; when this is in a very fine state of division, it is sometimes spoken of as *flowers*, e.g. the *flowers* of sulphur. Camphor, ammonium chloride, mercuric chloride, and various compounds are purified by this method, and are deposited as hard, compact masses.

SUBMARINES. Submarine boats, driven by hand-power, were constructed by Bushnell, an American, in 1775, and by Robert Fulton (q.v.) about 1800. A mechanically driven submarine was built in France in 1863; it was designed by C. Brun, was 146 feet long and 12 feet in diameter, and was driven by a compressed-air engine.

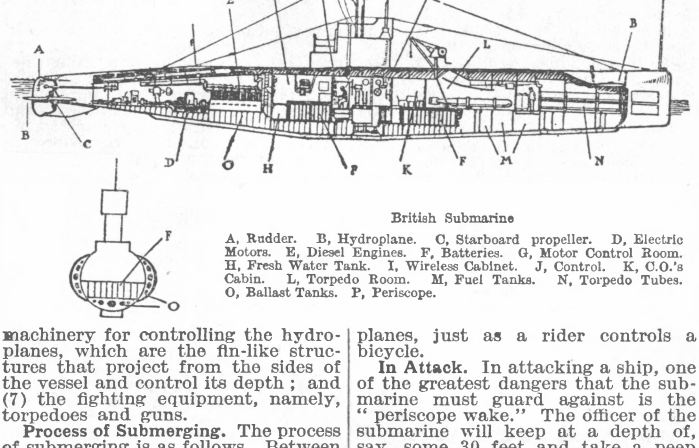
In 1877 an experimental boat was built by J. P. Holland, and in 1883 Nordenfeldt built a submarine at Stockholm. Speaking broadly, the modern submarine may be considered as due to these two inventors. In 1887 Holland and Nordenfeldt submitted competing designs to the United States Government. Holland's was the design accepted. It differed from Nordenfeldt's in being, as most modern boats are, a diving rather than a sinking device. In the earliest "A-type" boats of the British navy, the hull was constructed of ½-inch steel plate. A cylindrical tower, known as the conning-tower, is riveted on the top of the hull amidships. The conning-tower is provided with a lid about 18 inches in diameter, which opens outwards. A certain amount of air is imprisoned in the hull, and this is the air the crew breathes when the vessel is submerged.

There are various classes of submarines, some of such size and power that they are to all intents and purposes submersible cruisers. Others are more nearly destroyers, and as

such are capable of sinking the largest warships. Five British battleships and five cruisers are known to have been sunk by German submarines in the Great War, and the damage done by them to British mercantile shipping was almost incalculable.

Machinery. The machinery inside the vessel is extremely complex, and consists essentially of the following plant: (1) an oil-engine or steam-turbine; (2) an electric machine, which can be used either for propulsion or as a dynamo; (3) an electric storage battery; (4) an air-compressing installation; (5) steel bottles for storing compressed air; (6) machinery for controlling the hydroplanes, which are the fin-like structures that project from the sides of the vessel and control its depth; and (7) the fighting equipment, namely, torpedoes and guns.

Process of Submerging. The process of submerging is as follows. Between the bottom of the hull and the deck is a series of tanks into which seawater can be admitted by opening sea-cocks. These tanks are closed ones, so that, as the water enters them, the air above the water must be allowed to pass out into the body of the vessel through vent-pipes. As the first step before submerging the crew are ordered to their "stations," i.e. each man "stands by" the particular piece of mechanism or the valve that it is his duty to control. Prior to diving, the captain usually has a final look round, and closes the conning-tower hatch himself on descending into the boat. The order is then given to open certain sea- and vent-cocks, with the result that the selected tanks are filled with water. The boat now retains a small amount of positive buoyancy, i.e. it is just about to submerge. The final adjustment of buoyancy is more carefully made, so that the boat finally has a very slight amount of buoyancy before the sea-cocks and vent-cocks are finally closed. Meantime the main engine-coupling has been disconnected, and the electric motor switched in. The coxswain adjusts the tilt of the hydroplanes, so that the influence of the sea on them overcomes the slight buoyancy of the boat and submerges it to the depth required. The boat is kept running at a constant depth of submergence by altering the angle of the hydroplanes, just as a rider controls a bicycle.



British Submarine

A, Rudder. B, Hydroplane. C, Starboard propeller. D, Electric Motors. E, Diesel Engines. F, Batteries. G, Motor Control Room. H, Fresh Water Tank. I, Wireless Cabinet. J, Control. K, C.O.'s Cabin. L, Torpedo Room. M, Fuel Tanks. N, Torpedo Tubes. O, Ballast Tanks. P, Periscope.

In Attack. In attacking a ship, one of the greatest dangers that the submarine must guard against is the "periscope wake." The officer of the submarine will keep at a depth of, say, some 30 feet and take a peep at the quarry from time to time. He will take every precaution to avoid changing his depth in such a way as to oscillate or break surface. Changes of density of the sea-water, for instance, such as may occur in an estuary, are particularly disconcerting. Having discharged its torpedo by means of compressed air in the usual way, and made itself as much of a nuisance as it can to the enemy, the submarine leaves the scene of action as quietly as possible.

The problem is then to rise to the surface, for the operation of attack may have kept the ship submerged for any time up to eight hours or so. Rising is effected by compressed air. The vent-cocks of the tanks are closed and the sea-cocks opened. Compressed air is allowed to enter

the tanks, whereby the water is blown into the sea. The sea-cocks are then closed. In this way a definite positive buoyancy is regained, and the boat comes to the surface. The main engine is now coupled up to the propeller, and the boat is driven along the surface by means of steam power or oil. The motor is now run as a dynamo, and the battery is recharged. To renew the store of compressed air, which is used in diving, torpedo-firing, and rising, the air-compressors are set to work and the air-bottles recharged. The submarine is cleaned up, adjustments made to the batteries or machinery, and so on. After a few hours' run on the surface, the battery and air-bottles may be fully recharged, and the submarine is ready to make its next attack.

Repeated disasters to submarines, as e.g. the loss of the British submarine M2 in 1931, and opposition to their illegal use in warfare, have led to a movement for their abolition, which is supported by Great Britain.

SUBMERGED FORESTS. A term applied to beds of peat, with roots, stems, and branches of trees, etc., occupying the sites on which they grew, but which by change of level are now submerged by the sea. They belong to the recent or Quaternary period of geologists, and in the British Isles succeed the glacial deposits.

SUBORNATION OF PERJURY. *See* PERJURY.

SUBPŒ'NA. In law, a writ commanding a witness to appear in court under a penalty (*sub pœna*), which in England is of £100. When he is required to bring books or papers in his possession, a clause is inserted to that effect, and the writ is then called a *subpœna duces tecum* (" bring with you under penalty "). A witness is allowed his travelling expenses.

SUBSIDY. Literally, a grant-in-aid (Latin, *subsidium*, aid). Formerly it was a term applied to parliamentary grants to the Crown, but it is now used chiefly to denote assistance lent either by one Power to another in cash or arms, or by the State to various trades or industries. During the Napoleonic Wars Great Britain furnished subsidies to foreign Powers in order to enlist their assistance against the French, and in later times many Asiatic and African rulers have received subsidies to ensure their friendliness and good behaviour. From time to time various British industries, coal-mining, dyeing, sugar-beet, and others, have been subsidised. Shipping companies carrying mails or supplying auxiliary cruisers have regular subsidies.

SUBSTANCE (Lat. *sub*, under; *stare*, to stand). In philosophy, that which exists independently and unchangeably, as distinguished from *accident*, which denotes the changeable phenomena in substance. Substance itself is the essence which is capable of these phenomena, and in spite of any changes in the phenomena remains the same.

The fundamental doctrine of Descartes' philosophical system was the essential difference between mind or thinking substance and matter or extended substance. According to Spinoza, there is only one absolute, infinite substance, all beings being only " modes " of it. Leibnitz calls substance that which contains in itself the cause of its changes. In natural science and in common life, substance is used to designate material things, especially simple inorganic bodies, and the fundamental constituents of organic bodies.

SUBULA'RIA. A genus of plants, nat. ord. Cruciferæ, found in the gravelly bottoms of lakes, usually in shallow water, in North and Central Europe, North Asia, and the Northern United States. *S. aquatica*, or awl-wort, the only species, consists merely of a tuft of white fibrous roots, narrow awl-shaped leaves, and a leafless stalk, bearing a few small white flowers. It is indigenous to Scotland and the north of England and Ireland.

SUCCESSION DUTY. A duty levied on the interest to which a person succeeds on a death in respect (*a*) of real (heritable) property in the United Kingdom; (*b*) of charges on real property made by the deceased in exercise of any power or otherwise, and on the proceeds of sale of real property directed to be sold, or sold under a power, in the will of the deceased; and (*c*) of personal (moveable) property not liable to legacy duty, the deceased owner thereof having been domiciled in the United Kingdom.

The rates of succession duty and the rules governing its application in respect of relationship and value are the same generally as in the case of legacy duty (q.v.). Unlike that duty, however, succession duty need not be paid in one sum, but may be extended over a period of eight years, and paid in yearly or half-yearly instalments, with interest at the rate of 4 per cent per annum on the balance outstanding from time to time from one year after the opening of the succession. The duty is a first charge on the interest of the suc-

cessor, on whom is the obligation to declare his accountability.

SUCCESSION, WARS OF. Dynastic disputes have been responsible for many military conflicts in European history, and in a large proportion of instances the struggle was not purely a civil war, but was also an opportunity for foreign intervention. The Scottish War of Independence was the result of a disputed succession, and in the Hundred Years' War a dynastic controversy afforded the formal excuse for English efforts to conquer France. The term " Wars of Succession " is, however, generally employed to describe four eighteenth-century conflicts—the Wars of the Spanish, Polish, Austrian, and Bavarian Successions.

Spanish. The War of the Spanish Succession (1702-13) was a result of the enormous extent of the possessions belonging to the Spanish Crown, and of the determination of Austria, Britain, and other Powers to check the aggrandisement of France. Before the death of the childless Spanish king, Charles II., in 1700, efforts were made to arrive at a peaceful settlement by means of Partition Treaties, dividing the heritage among the three claimants—Philip, Duke of Anjou (a grandson of Louis XIV.); Joseph, Electoral Prince of Bavaria; and the Archduke Charles of Austria. Philip was a grandson of the elder sister, and Joseph of the younger sister, of Charles II., but both these princesses, on making foreign marriages, had renounced their rights of succession to the Spanish throne; the Archduke Charles was the grandson of an aunt of Charles II. who had made no renunciation.

The death of Joseph in 1699 nullified an agreement among the Powers that he should succeed to Spain, the Spanish Netherlands, and the colonies, while Philip was to have Naples and Sicily, and Charles, Milan. A second agreement, to which Louis XIV. assented, gave to Charles all the Spanish possessions except Milan, which it was agreed that Philip might exchange for Lorraine. But when Charles II. left all his possessions to Philip, the old French king accepted the inheritance for his grandson, and the Powers began to prepare for war, which broke out in 1702.

The Grand Alliance, of which the chief members were Great Britain, Austria, and Holland, was successful in the war, largely owing to the military genius of the Duke of Marlborough; but the allies were jealous of each other, and the persistence shown by France in continuing a hopeless struggle was rewarded by better terms in 1713 than could have been obtained earlier.

The whole situation was changed in 1711 by the succession of the Archduke Charles to the Austrian crown as the Emperor Charles VI. This event made him, from the British standpoint, a less desirable candidate for the Spanish throne than Philip of Anjou, for he would unite Austria and Spain, whereas Philip was not the heir to the French throne. This consideration explains the readiness of Great Britain, as reflected in the Treaty of Utrecht, to acknowledge Philip V. King of Spain, on condition that the French and Spanish Crowns should never be united. Austria, which came to terms with France in 1714, received Naples, Milan, Sardinia, and the Spanish Netherlands.

Polish. The War of the Polish Succession (1733-5) originated in the determination of France to place Stanislaus Leszcynski, father-in-law of Louis XV., on the elective throne of Poland as part of a forward foreign policy which included an alliance with Spain against Austria. Stanislaus was duly elected, but was soon driven out of Poland by Russians and Saxons, who supported his rival, Augustus of Saxony. The war ended in the establishment of Augustus on the throne.

Austrian. The War of the Austrian Succession (1740-8) was fought over the claim of Maria Theresa to succeed to the Habsburg dominions which had belonged to her father, the Emperor Charles VI. By a document known as the Pragmatic Sanction, Charles had obtained a recognition of his daughter's right, and on his death she was accepted as their ruler by the people of Austria, Hungary, and Bohemia. But Frederick II. of Prussia seized Silesia, an appanage of the Bohemian Crown, and (1742) Maria Theresa consented to a surrender of the greater part of the province in order to prevent an attack by France and Prussia upon the Austrian Netherlands.

She had also a rival in the new emperor, the Elector of Bavaria, who was married to the daughter of an elder brother of Charles VI., and claimed that his wife had a better title to the Habsburg territories than her cousin. Spain, in the hope of securing Austrian territory in Italy, joined France and Bavaria. Great Britain, under George II., intervened on behalf of Austria, and by the Treaty of Worms (1743) Britain, Austria, Holland, Sardinia, and Saxony combined to maintain the Pragmatic Sanction. This treaty did not recognise the cession of Silesia to Prussia, and Frederick II. joined

Spain, France, and Bavaria. The war thus became a general European conflict.

In 1745 the Emperor Charles VII. (Elector of Bavaria) died, and Maria Theresa secured both the adhesion of Bavaria to her cause and the election of her husband as the Emperor Francis I. The struggle continued, with variations both of fortune and of alliances, until 1748, when, by the Treaty of Aix-la-Chapelle, Maria Theresa retained her inheritance, with the exception of Prussian Silesia.

Bavarian. The War of the Bavarian Succession (1778-9) was connected with Austrian ambitions. On the death of the childless Elector Maximilian Joseph, the Emperor Joseph II. wished to obtain the succession, to the detriment of the Elector Palatine, Charles Theodore, and Austrian troops invaded Bavaria. Charles Theodore acquiesced, but his heir, the Duke of Zweibrücken, appealed to France and Prussia; there were some hostilities, but the Austrians did not persist, and the succession of Charles Theodore was recognised by the Peace of Teschen (1779).—BIBLIOGRAPHY: W. E. H. Lecky, *History of England in the 18th Century*; *Cambridge Modern History* (vols. v. and vi.).

SUCCINIC ACID ($CO_2H{\cdot}CH_2{\cdot}CH_2{\cdot}CO_2H$). A dibasic acid obtained originally by the dry distillation of amber, now often prepared synthetically by fermenting a solution of ammonium tartrate. It forms large colourless prisms of melting-point 185° C. The acid is used in analysis and in separation of some of the rare earths.

SUCCULENT PLANTS. Those xerophytes (q.v.) in which the leaves or stems or both are fleshy, owing to the presence of a large proportion of water-storing cells, as cacti, many Euphorbias, Agave, glasswort, etc.

SUCHET (sü-shā), **Louis Gabriel,** Duc d'Albufera da Valencia and Maréchal de France, French soldier, one of the most brilliant of Napoleonic commanders, born 1770, died 1826. The son of a silk manufacturer, he took part in the siege of Toulon (1793) and captured General O'Hara. He served successively under Joubert (Tirol campaign, 1797), Brune (1797-8, to whom he became Chief of Staff), Joubert (1799, as general of division and Chief of Staff), and Masséna (1800, second in command).

In the 1805-6 campaigns he gained a great reputation, and married a niece of Joseph Bonaparte's wife. In Spain he extirpated the armies of Blake and O'Donnell, and (1812) was raised to the peerage. Louis XVIII. made him a peer of France at the Restoration, but by his adherence to Napoleon during the Hundred Days, when he commanded one of the armies of the east, he lost honour and titles.

SUCKER, or **SUCKING-FISH.** A name applied popularly to the Remora (q.v.), to the lump-sucker (q.v.), and also to the fishes belonging to the teleostean genus Lipăris, which is nearly allied to the lump-suckers. The best-known forms are Montague's sucker (*Lipăris montagui*) and the common sucker or sea-snail (*L. vulgăris*), which adhere to stones and other fixed objects by means of their united ventral fins. They are small fishes, 3 or 4 inches long.

SUCKLING, Sir John. English poet, courtier, and dramatist, born in 1609, died in 1642. His father was a Privy Councillor and Secretary of State. He was educated at Trinity College, Cambridge, where he did not graduate. At the age of eighteen he inherited rich estates in Suffolk, Lincolnshire, and Middlesex. He travelled in France and Italy, and was knighted in 1630, on his return. He became a leading member of the gay court circle.

In 1631 he joined the Marquess of Hamilton's force which served under Gustavus Adolphus. On the outbreak of the Scottish campaign of 1639 he raised and elaborately equipped a troop of horse for the king. Subsequently he was implicated in what was known as the "first army plot," and fled to France, where he is believed to have committed suicide at the age of thirty-three.

The writing of verses and plays was merely Suckling's relaxation; soldiering was his avocation; his vocation was playing cribbage (which he invented) and bowls. His three plays, *Aglaura*, *The Goblins*, and *Brennoralt*, are chiefly memorable for their elaborate mounting, which resembled that of masques, and for their lyrics. Suckling is less remarkable for his own plays than for being an ardent admirer of Shakespeare. In the best extant portrait of him he is represented as holding a copy of the First Folio.

In his songs and lighter pieces, for which he is chiefly famous, he definitely broke away from the Jonsonian tradition. In the best of his pieces, *A Ballad upon a Wedding*, instead of following wearily in the wake of Catullus, he adopted a new style of his own. His best-known lyrics are "Out upon it! I have loved" and "Why so pale and wan, fond lover?". Among his other works there is, oddly enough, a tract against Socinianism entitled *An Account of Religion by Reason*. Suckling's lyrics are distinguished for their gaiety, ease, and spontaneity,

but do not display imagination of a high order.

SUCRATE. A compound of a sugar, e.g. grape-sugar or cane-sugar, with such oxides as those of calcium, barium, and strontium. Examples are: $C_{12}H_{22}O_{11} + CaO + 2H_2O$; $C_{12}H_{22}O_{11} + 2CaO$.

SUCRE. *See* CHUQUISACA.

SUCRE (sō'krā), **Antonio José de.** Venezuelan soldier, born 1793, died 1830. In 1811 he took part (under Bolivar) in the rising against Spain, won the battles of (1812) Pinchincha (which freed Ecuador) and (1824) Ayacucho. Ayacucho liberated Upper Peru, which became the Republic of Bolivia, with Sucre as life President (1826). He was driven out by an insurrection (1828), but reinstated himself at the head of a Colombian army (battle of Giron, Feb., 1829), and was later assassinated.

SUCTO'RIA (" sucking animals "), also called Discophora and Hirudinea. An order of Annelida or segmented worms, represented by the leeches (q.v.) and their allies.

SUDAN, THE. A geographical region of Northern Africa, extending between the Atlantic and the Nile Valley, and forming an area of transition between the humid forests of Equatoria and the arid wastes of the Sahara. Politically it is partitioned as follows: Senegal, French Guinea, Ivory Coast, Dahomey, Mauritania, Upper Volta, French Sudan, and Niger Colony are French. British possessions are: Sierra Leone, Gambia, Gold Coast, and Nigeria. Liberia is independent, and there is a Portuguese colony of Guinea. The term Sudan, however, is applied officially to the Anglo-Egyptian Sudan. Togoland (q.v.) was mandated to Great Britain and France after the European War.

SUDAN, THE, or **ANGLO-EGYPTIAN SUDAN** (Ar. *Blad-es-Sudan*, land of the blacks). A country of North-Eastern Africa, extending between Egypt (south of 22° N. lat.) and Uganda, and between the Red Sea and Wadia (Central Africa). Area, 1,008,100 sq. miles. The population, half of which is negroid and is found in the equatorial region, is 5,605,848.

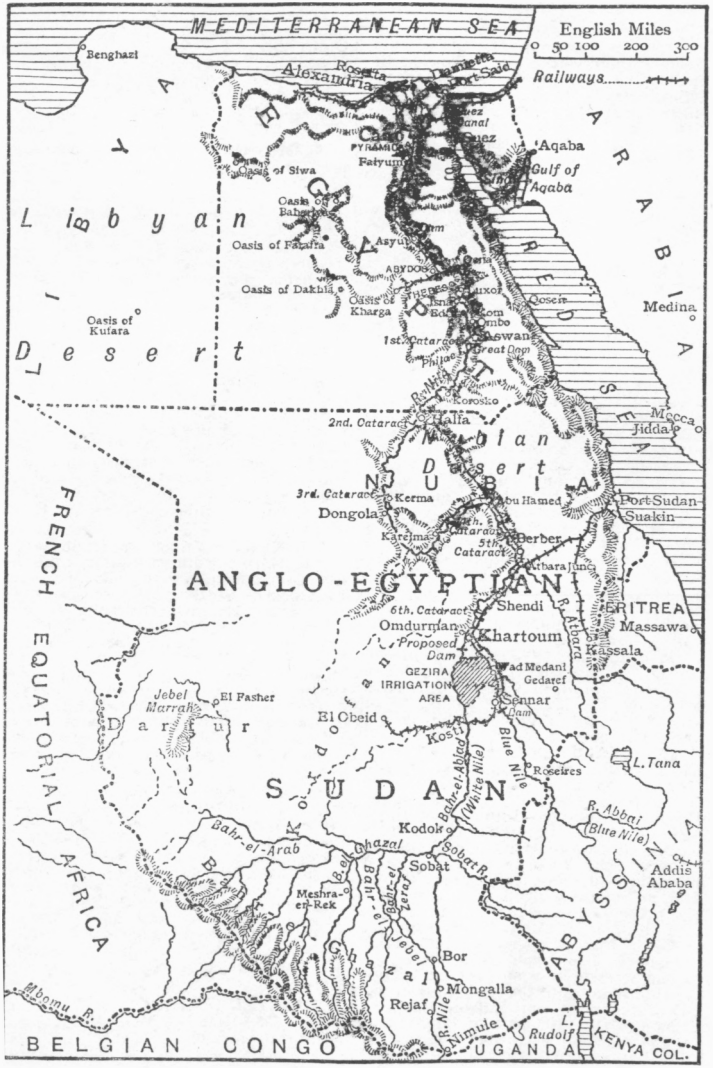
Physiography. The Sudan is low and flat in the centre and north, mountainous in the east, hilly towards the west, and elevated in the south-west, between the Nile and Congo basins. West of the Nile are the Libyan and Bayuda Deserts; east of the Nile is the Nubian Desert. Oases and wells include: Selima, Lagia (Al-Agia), and Al-Hafra. The Nile, however, is the greatest physical feature, with its tributaries (right bank) Sobat, Blue Nile, Atbara; and (left bank) the Bahr al-Ghazal, with its affluents the Bahr al-Arab, Jur, Bahr Tonj, and Lol. The Sudan occupies the middle region of the Nile basin.

Climate. Lying within the tropical zone, the whole region is climatically hot, but with variations according to locality, in view of the size of the country. The south and easterly parts (towards the Abyssinian plateau) are regions of great rainfall; in the north there is comparatively little rain, and where there is none the country is desert. The north is hot in summer, dry and cool in winter, and generally healthy; the east is cooler, but decidedly unhealthy in the river valleys; the south is hot, humid, and unhealthy. The negro people are found among the swamps, tropical forests, and savannahs of the south, and in the central and northern areas and the cultivable lands are the Arabs.

Communications. There are two trunk lines of railway: (1) the Wadi Halfa-Khartoum and (2) the Red Sea. The first is connected by boat with Shellâl (Aswân), the terminus of the railway from Alexandria (Egypt) via Cairo, and from Halfa it leaves the Nile, strikes across the desert to Abû-Hamed, whence it follows the right bank of the Nile to Khartoum; length, 575 miles. The Khartoum extension runs beside the Blue Nile and across the Gezira to Sennar, whence it strikes west across the White Nile to El Obeid; length, 350 miles.

Atbara is the junction for (2), running to Port Sudan (q.v.) and Suakin (498 miles); and from Abû-Hamed a line runs to Karima (138 miles). A new line was opened in 1929 between Gedaref and Makwar (143 miles). Total length of railway lines, 1995 miles. Steamer traffic is maintained on the White Nile as far south as Lado and Gondokoro (Uganda); but in the Upper Nile and the Bahr al-Ghazal sudd-cutters and dredgers are necessary to cope with the *sudd* or masses of water-weeds that choke the watercourses. Of the six cataracts of the Nile, five of them impede river traffic in the great meander between Khartoum and Halfa.

Production. Sudan leads the world in the production of gum-arabic (mainly from Kordofan) and ivory. In 1931, 20,086 tons of gum-arabic were exported. Agriculture is confined, north of Khartoum, to the Nile Valley, and is assisted by irrigation. Under the Gezira Irrigation Scheme the area under cotton cultivation was


MEDITERRANEAN SEA
English Miles
0 50 100 200 300
Railways
Benghazi
Alexandria
Rosetta
Damietta
Port Said
Suez Canal
Suez
Aqaba
Gulf of Aqaba
ARABIA
EGYPT
Libyan Desert
Oasis of Siwa
Oasis of Bahariya
Oasis of Farafra
Oasis of Dakhla
Oasis of Kharga
Oasis of Kufara
PYRAMIDS
Fayum
Asyut
ABYDOS
Luxor
Esna
Edfu
Kom Ombo
Aswan
Great Dam
Philae
1st. Cataract
Wadi Halfa
2nd. Cataract
Korosko
Nubian Desert
NUBIA
3rd. Cataract
Kerma
Dongola
Abu Hamed
4th. Cataract
Karema
5th. Cataract
Berber
Atbara Junc.
Port Sudan
Suakin
Mecca
Jidda
Medina
RED SEA
FRENCH EQUATORIAL AFRICA
ANGLO-EGYPTIAN
SUDAN
ERITREA
6th. Cataract
Shendi
Omdurman
Proposed Dam
Khartoum
Atbara R.
Massawa
Kassala
GEZIRA IRRIGATION AREA
Wad Medani
Gedaref
Sennar Dam
Jebel Marra
El Fasher
Darfur
El Obeid
Kosti
Blue Nile
Roseires
L. Tana
Bahr-el-Abiad (White Nile)
Bahr-el-Arab
Kodok
Bahr-el-Ghazal
Sobat R.
Sobat
Addis Ababa
ABYSSINIA
Meshra-er-Rek
Bahr-el-Zeraf
Bahr-el-Jebel
Bor
Mongalla
Rejaf
Nile R.
Nimule
L. Rudolf
KENYA COL.
UGANDA
BELGIAN CONGO
M'bomu R.

increased to 193,979 acres (1932); other cotton-growing areas are the Gash and Baraka Deltas. American cotton is produced under irrigation in Berber. Cotton (Egyptian) has been introduced in the Tokar district (Red Sea Province) and in the Nile Valley. Durra and dukhn (both millets) are the chief crops; sesame, dates, senna leaves and pods, hides, skins, and gold are other products.

Towns. Khartoum is the capital, but Omdurman (the Khalifa's capital) is larger. Khartoum North, Wadi Halfa, Merowé, El Damer, Atbara, Port Sudan, Suakin, Kassala, Ed Dueim, Kosti, El Obeid, Wad Medani, Nahud, and El Fasher (the former capital of Darfur, which was annexed in 1916; *see* SENUSSI) are the chief places.

Social Conditions, etc. All the Arab tribes profess Islam; the negro tribes are mainly pagan, although some have been converted to Mahommedanism. There is a central education authority which controls *kuttabs* or elementary vernacular schools (about eighty in number) for boys between seven and ten years of age. At Khartoum, Omdurman, El Obeid, and elsewhere there are primary schools in which English is taught side by side with Arabic and mathematics. Gordon College, Khartoum, can be entered direct from the primary schools. An agricultural research department, geological survey, and the Wellcome Tropical Research Laboratory are maintained. There are also industrial workshops at Omdurman, Khartoum, and Atbara.

Government. There are fifteen provinces (*mudirias*) each under a Governor (*mudir*), who is a British officer of the Egyptian army. Provinces are subdivided into districts, and over one or more a British Inspector is appointed, who is assisted by Egyptians and Sudanese. Laws, etc., are promulgated by the Governor-General in Council. The Anglo-Egyptian Sudan is administered under a condominium in virtue of an Anglo-Egyptian Convention, completed at Cairo on 19th Jan., 1899. British and Egyptian flags are flown side by side, and no customs duties are levied on Egyptian commerce. Slavery is absolutely prohibited, and the import of liquor and weapons is under strict control. The exact status of the Sudan was made a subject for future consideration on the recognition by Britain of Egyptian national aspirations and the elevation of King Fuad to the Egyptian throne. Egyptian troops were evacuated in 1924, and a Sudan Defence Force, owing allegiance to the Governor-General, was created. *See* EGYPT for résumé of history. It is important to see GEZIRA.

BIBLIOGRAPHY: Slatin Pasha, *Fire and Sword in the Sudan*; W. S. Churchill, *The River War*; P. F. Martin, *The Sudan in Evolution*; handbooks published by H.M. Government relating to the Sudan generally, postal services, forestry, travel and sport, and traffic, etc.

SUDBURY. A muncipal borough and market town of Suffolk, England, on the Stour. It was known to the Saxons as *Sudberi* (*Suthberie*), was one of the first towns selected by Edward III. for the settlement of Flemings and the establishment of woollen manufactures, and was made a borough by Queen Elizabeth. The grammar-school was founded in 1491. Manufactures include flour, coco-nut matting, and malt. Pop. 7007.

SUDBURY. A county town of Ontario, Canada; served by the Canadian Pacific, National (two lines), and Algoma East Railways. It is the centre of the nickel region (sulphides), from which 80 per cent of the world's supply is derived. There are large smelters, creamery, foundry, machine-shops, etc. A Government school of mines is carried on in connection with the local technical school. Pop. 18,518.

SUDELEY. Village of Gloucestershire. Here is Sudeley Castle, built in the fourteenth century by Thomas Boteler, the Lord Sudeley of a former creation. It was subsequently acquired by the fourth husband of Catharine Parr, the widow of Henry VIII. Catharine married Lord Thomas Seymour of Sudeley, a former lover, very soon after Henry's death in 1547, and died in childbirth at Sudeley Castle the following year. It was restored in the nineteenth century, and is still a place of residence.

SUDERMANN, Hermann. German novelist and dramatist, born 1857. He won European fame in 1888 with his first play, *Die Ehre*, and his novel *Frau Sorge* (English translation, Dame Care). Among his other works are: the novels *Der Katzensteg* (English translation, Regina) and *Das hohe Lied*, and the dramas *Heimat* (English translation, Magda), *Es lebe das Leben* (The Joy of Living), and *Der Gute Ruf*. He died in Berlin 1928.

SUDETENGEBIRGE (sö-dā'tn-gebir-gĕ), or **SUDETIC MOUNTAINS.** A mountain range of Central Europe, extending east from the Elbe valley to the Oder and continued by the Carpathians. Schneekoppe in Riesengebirge (q.v.) is highest (5260 feet).

SUDORIFICS. Measures used in medicine to produce profuse sweating. The glands of the skin are of two kinds —the sweat-glands, and glands which, from the greasy nature of their secretion, are termed *sebaceous*. These lubricate the hairs covering the body, while the sweat-glands perform a dual function in the excretion of waste product and, since evaporation from any surface involves a lowering of its temperature, the regulation of body heat. Normally about a quart (1000 c.c.) of sweat is poured out daily, containing from 4 to 5 per cent of the total nitrogen excreted from the body; but this amount may be very considerably increased if the action of the kidneys is interfered with.

A nervous mechanism, capable of direct and reflex stimulation, controls sweat secretion, and certain drugs stimulate the glands themselves. In disease a knowledge of these facts is made use of to reduce fever, or to expedite the excretion of toxic bodies from the blood, whether they are normal physiological products which the kidneys fail to eliminate, or poisons generated by micro-organisms. Antimony and ipecacuanha stimulate sweating indirectly through the stomach. Hot, spiced drinks have the same effect, by acting upon the nerve-endings of the mouth and throat, as well as upon those of the stomach. Ammonium salts, camphor, strychnine, pilocarpine, physostigmine, and nicotine stimulate the central nervous mechanism. All these drugs and some others are used as sudorifics, while not the least valuable method of securing sweating is the application of heat, moist or dry, which, by dilating the vessels, facilitates diaphoresis.

SUE (sü), **Marie-Joseph-Eugène.** French novelist, born at Paris in 1804, died in 1857. He became a surgeon in the army, and served in Spain in 1823. In 1825 he joined the naval service, and was present at the battle of Navarino in 1827. On his father's death in 1829 he inherited an immense fortune, and, having abandoned his profession, he devoted himself to literary composition.

His first work was a sea novel entitled *Kernock le Pirate*, which was quickly followed by *Plick et Plock*, *Atar-Gull*, *La Salamandre*, and *La Vigie de Koatven*. He now entered the departments both of historical fiction and the novel of real life. Of the former description were *Latreaumont*, *Jean Cavalier*, and *Le Commandeur*; of the latter were *Arthur*, *L'Hôtel Lambert*, and *Mathilde*. But his most famous works are *Les Mystères de Paris* and *Le Juif Errant*. His later novels are *L'Enfant Trouvé*, *Les Sept Péchés Capitaux*, and *Les Mystères du Peuple*. In 1850 he was elected to the Constituent Assembly, and sat as an advanced radical. After the *coup d'état* by Napoleon III. in 1851 he left Paris and retired to Annecy.

SUECA (sụ-ā'kà). A town of Valencia, Southern Spain, on the Jucar. It is an agricultural centre. Pop. 17,000.

SUET. The fatty tissue situated about the loins and kidneys of certain domestic animals, especially the ox and sheep, and which is harder and less fusible than the fat from other parts of the same animals. Beef-suet is much used for culinary purposes, and purified mutton-suet forms an ingredient in ointments, cerates, and plasters.

SUETO'NIUS (Gaius Suetonius Tranquillus). Roman historian or anecdotist; he lived during the end of the first and the first half of the second century A.D. Very little is known about his life. He was a friend of Pliny the Younger, and began life as an advocate. He became *magister epistolarum* or private secretary to the Emperor Hadrian; this position probably gave him access to many official and private documents. He was deprived of his office for behaving contrary to court etiquette, and devoted himself to literature.

He was a voluminous writer; his works, which were almost encyclopedic in their range, dealt with such subjects as Greek games, Roman shows, shorthand, costume, words of ill-omen, and pedigrees. All these works are lost; short lives of Terence, Horace, Lucan, and Pliny the Elder are preserved, as are fragments of his books *On Famous Schoolmasters* and *On Famous Professors*. His reputation, however, rests upon his *Lives of the Twelve Cæsars*, or lives of the twelve emperors from Julius Cæsar to Domitian.

If it be true that the style is the man, it might be argued that Suetonius never existed. He has no style; he sets down his extremely interesting material just as it occurs to him. His prose is a pleasant contrast to the florid prose of Seneca, but it is not the work of a literary artist. He has, however, many good qualities. He does not point a moral any more than he adorns his tale; he lets the facts tell their own story. He is accurate; his work shows considerable research and complete honesty. He compresses a great deal of information into a very small compass. But he ranks as a chronicler rather than as an historian; the

great value of his work is due to the number of personal anecdotes about the emperors which he has preserved.—Cf. J. C. Rolfe, *Suetonius* (text and translation, Loeb Classical Library).

SUE'VI. The general name of a number of united tribes who, before the Christian era, inhabited parts of Germany. The confederation included the Marcomanni and the Semnones, the former inhabiting what is now Bohemia, and the latter the present Lusatia and Brandenburg. The Suevi of Cæsar lived between the Rhine and the Weser. In the great migration of the northern nations the Suevi joined the Alans, entered Gaul, and in 409 Spain. After the Vandals had gone to Africa the Suevi spread as far as Portugal. They were overcome and absorbed by the Visigoths in 586, but the name still lives in *Suabia* (q.v.).

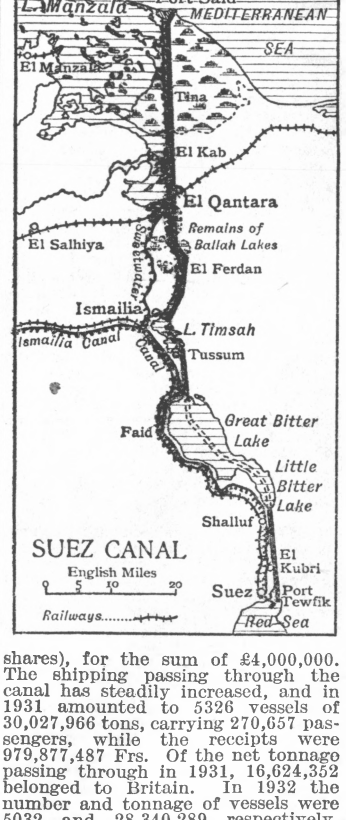
SU'EZ. A town of Egypt, on the Gulf of Suez, the Red Sea terminus of the Suez Canal. Previous to the construction of the Suez Canal, and the freshwater Ismailia Canal from the Nile, it was a miserable place. Pop. (1927), 40,523.

SUEZ CANAL. The great ship-canal without locks connecting the Mediterranean with the Red Sea; running from Port Said on the former to Suez on the latter, a distance of 103 miles.

According to Herodotus, a large canal from the Red Sea to the Nile was constructed about 600 B.C. This canal, which seems never to have been of much use, was finally blocked up about A.D. 767. Napoleon I. had conceived the idea of making a ship-canal across the Isthmus of Suez. In 1854 the French engineer M. Ferdinand de Lesseps obtained a concession for that purpose, and in 1858 was able to form a company. Operations were begun on the 25th April, 1859, and on the 17th Nov., 1869, the canal was opened. There were about 80 miles of actual excavation, the remainder being through shallow lakes (Menzaleh, Timsah, Bitter Lakes), which usually required deepening. Total length, 103 miles. For about four-fifths of its length it was originally 327 feet wide at the surface of the water, but improvements have been carried out at various times, and the present dimensions are: minimum surface width, 147 ft. 8 in.; minimum depth, 34 feet (maximum draught allowed, 33 feet). This is the depth as increased in 1929.

A canal (Ismailia Canal) was also constructed for bringing fresh water from the Nile at a point near Cairo. This canal reaches the salt-water canal at Ismailia, and then runs almost parallel to the ship-canal to Suez. It is used for navigation as well as for domestic purposes and irrigation.

In Nov., 1875, the British Government bought from the Viceroy of Egypt his interest in the canal, consisting of 176,602 500-franc shares (divided in 1924 into 250-franc



shares), for the sum of £4,000,000. The shipping passing through the canal has steadily increased, and in 1931 amounted to 5326 vessels of 30,027,966 tons, carrying 270,657 passengers, while the receipts were 979,877,487 Frs. Of the net tonnage passing through in 1931, 16,624,352 belonged to Britain. In 1932 the number and tonnage of vessels were 5032 and 28,340,289 respectively. Navigation at night by aid of electric light began in 1887. The distance between London and Bombay by the old route round the Cape is about 11,202 miles; by the canal route, 6332

miles. The average time taken in transit is 15 hours. The canal is managed by a council of 32 administrators, 10 of whom are British. The agreement of the Suez Canal Company ends in 1968.

SUFFOLK (suf'ok ; literally southfolk). A maritime county of England, bounded by the North Sea, Essex, Norfolk, and Cambridgeshire. It has a coast-line of about 62 miles, and an area of 948,269 acres.

Among rivers are : the Lark, a tributary of the Great Ouse ; the Stour, which passes Sudbury and flows into the sea at Harwich ; the Gipping, which runs from Stowmarket to Ipswich, and thence, under the name of the Orwell, to Harwich, where it unites with the Stour ; the Deben, the Alde, and the Blythe. Suffolk is for the most part flat, and the soil on the north-western and eastern borders of the county is very sandy. The sea has made great encroachments on the Suffolk coasts, and has partially destroyed some once considerable towns, as Dunwich and Aldeburgh.

Agriculture is progressive. The seaports export corn and malt, and herring, mackerel, and oyster fisheries are carried on. Ipswich is the county town, the next in importance being Lowestoft. Pop (1931), 401,114.—Cf. W. Page (editor), *Victoria Histories of the Counties of England : Suffolk.*

SUFFRAGE. By the Representation of the People (Equal Franchise) Act, 1928, men and women were first put on an equal footing. The following are the conditions under which they can be registered as Parliamentary electors : the individual must be 21 years of age, and have resided for three months in any one constituency or contiguous constituency in the same Parliamentary borough, or have occupied for business purposes land or premises of £10 annual value for the same period.

The qualifications are now the same for both sexes for the Local Government franchise.

Degree holders are entitled to be registered for university constituencies.

Great extensions of the suffrage have taken place since 1832, when the first Reform Act was passed. Other extensions took place in 1869 and 1885, and in 1918 women were first admitted to the franchise (q.v.).

SUFISM, or **SOOFEEISM.** The pantheistic mysticism and asceticism of Islam, which reached its highest stage of development in the fourth century A.H. (i.e. after *Hijra* : the eleventh century of the Christian era). After the initial period of Muslim conquest, with its attendant evils of accumulated wealth and luxurious taste, a movement back to a purer religious code became manifest, and secured many adherents, who were conspicuous by their excessive abstinence and fanatical devotion no less than by their exceptional efficiency as preachers and reformers.

The actual date of introduction of a pantheistic dogma is unknown, but constant meditation on the text of the *Koran*, combined with features of asceticism, and the revivalist spirit, has resulted in the evolution of a theology which has little in common with the message of that work. Modern Sufic orders are exclusive, and a novitiate is necessary ; there is a definite ritual, and oratories, meeting-houses, and hostels bind together the members with religious ties in such a manner as to render the corporate orders of considerable use as political organisations. Sufism has been the inspiring force of nearly all the best poetry of Persia, especially the writings of Hafiz and Sadi. *See* SENUSSI.

SUGAR. A name given to a number of sweet-tasting substances of similar constitution which occur principally in the vegetable kingdom. Chemically they consist of polyhydric aldehydic or ketonic alcohols, which constitute a large section of the class of compounds known as *carbohydrates*, so termed from the fact that they contain hydrogen and oxygen in the proportion to form water.

Sugars may be divided into two classes, namely, the *monosaccharoses* having the formula $C_6H_{12}O_6$, and the *disaccharoses* with the formula $C_{12}H_{22}O_{11}$. *Glucose* (dextrose or grape-sugar), *fructose* (lævulose or fruit-sugar), *mannose*, and *galactose* are monosaccharoses, whilst *sucrose* (cane-sugar), *maltose* (malt-sugar), and *lactose* (milk-sugar) are disaccharoses. The former are not decomposed by dilute acids, but the latter are readily hydrolysed to a mixture of equal parts of two different monosaccharoses, or to one only. Thus from sucrose a mixture of glucose and frutose is obtained ; from lactose, glucose and galactose ; and from maltose, glucose alone.

All sugars are optically active, i.e. a solution of a sugar rotates the plane of polarised light either in a right-handed (dextro-rotatory) or left-handed (lævo-rotatory) manner (*see* POLARISATION OF LIGHT ; SACCHARIMETER). According to theo-

retical considerations, there should be eight different aldehydic monosaccharoses, each existing in two optically active forms; these sixteen forms are now all known, the majority having been prepared synthetically. It is mainly due to the work of the late Emil Fischer that the chemical structure and configuration of the sugars has been elucidated.

Cane-sugar. The term sugar is commonly used to specify a particular member of the class, namely, *cane-sugar*, which is the most important one from the commercial and domestic point of view. This sugar occurs in sugar-cane, sugar-beet, and also in the maple, sorghum, and other plants, but the first two form the principal sources of supply.

Originally introduced from India in the time of Alexander the Great, the sugar-cane gradually spread through Southern Europe; it was planted in the West Indies in the fifteenth century, soon after the discovery of America, and is now grown in most tropical and subtropical countries. The ripe plant, which contains from 15 to 20 per cent of sugar, is crushed between rollers to remove the juice, the crushed cane being further extracted with hot water. The juice is then treated with sulphur dioxide gas to prevent fermentation, and boiled down to a thin syrup. Milk of lime is added to neutralise vegetable acids and precipitate albuminous products, and, after skimming, the concentration is continued in steam-heated vacuum pans until crystallisation begins. The crude sugar thus obtained is separated from the syrup (molasses), which may contain uncrystallisable products, by draining or centrifuging. It is then packed for sale as ordinary brown sugar, or refined to produce white sugar.

Beet-sugar is obtained from the sugar-beet, a cultivated variety of the sea-beet (*Beta maritima*) which grows wild on muddy sea-shores. The sugar manufactured in France, Belgium, Germany, and other European countries is obtained almost exclusively from the sugar-beet, which is grown as a field crop, and contains about 15 per cent of sugar.

In 1747 sugar was first extracted from the beet by Marggraf, the first factory for this purpose being built near Breslau in 1799. In 1912 the first modern factory in England was opened at Cantley, in Norfolk; and in 1921 a factory was established at Kelham, Notts, the British Government subscribing £250,000 of the capital. In 1923 the Cantley and Kelham factories contracted for 15,000 acres of beet. The average yield per acre is about 10 tons, but in individual cases this may be much exceeded; in 1922, for instance, the yield which won the Mason cup for beet-growing amounted to 18 tons 6 cwt. per acre, with an average sugar content of 15·4 per cent. The world's production of beet-sugar is now about half that of cane-sugar.

The process of manufacture of sugar from the beet differs considerably from the process used for cane-sugar. The roots are trimmed, cleansed by washing, and cut up into very thin slices by special machines. The sugar is then extracted by a process based on the phenomenon of osmosis or membrane diffusion. The beet consists of a structure of cells, each of which contains sugar juice surrounded by a membrane. On soaking in water, the sugar and other substances capable of crystallisation (crystalloids) pass through the membrane into the water, whilst non-crystallisable substances (colloids), such as albumin, gum, and pectins, are scarcely able to penetrate the membrane. This process will continue until the concentration of sugar in the water is equal to that remaining in the cells. If this solution is replaced by pure water, a further quantity of sugar will pass out of the cells. In practice the sliced beet is placed in a series of from ten to sixteen closed vessels connected up in a circle to form what is known as a diffusion battery. Pure water, heated to 60° or 70° C., is passed through the vessels so that it first comes in contact with cuttings which have been nearly exhausted, the sugar solution as it gets stronger meeting fresher and fresher cuttings. As the contents of each vessel are exhausted, it is cut off from the battery, filled with fresh cuttings, and placed last in the series. The diffusion process is sometimes carried out by forcing the cut beet slowly through a long cylinder in the opposite direction to a stream of hot water, thus dispensing with the need for a series of separate vessels.

The exhausted cuttings, which should not contains more than 0·4 per cent of sugar, are pressed and used as fodder. The crude juice, in addition to sugar, contains salts, colouring-matters, gelatinous and other impurities, which prevent crystallisation. These are removed by heating with lime (*separation*), the excess of lime being precipitated as chalk by passing in carbonic acid gas (*saturation*). The impurities are thereby either transformed into

insoluble lime salts or carried down by the precipitate of chalk which is formed. The juice is then separated from the mud by filtration, and the sugar obtained by evaporation, etc., as in the case of cane-sugar.

Refining. The crude sugar, from whichever source it is obtained, is usually purified (refined) in special works. There are two methods in use. The first consists in covering the material with a solution of pure sugar, which gradually dissolves the syrup clinging to the crystals; these are then separated in centrifugal machines and allowed to dry. In the second method, the crude sugar is dissolved in hot water, filtered to remove suspended matter, and then run into steam-heated iron cylinders packed with bone charcoal, where it is allowed to remain until decolorised. The purified solution is then evaporated in steam-heated vacuum pans at a temperature of 82° C., more being added to the pan as the process continues. When crystals have been formed in sufficient amount, the pasty mixture or *masse cuite* is run off into centrifugals; the sugar remaining is washed in the machine with a spray of water, and finally dried and packed. The slightly yellow tint of the sugar may be concealed by adding a very small quantity of a blue colouring-matter, such as ultramarine. The syrups are evaporated further to yield a lower grade sugar, the final residue in the case of cane-sugar being converted into golden syrup.

The syrups obtained in the manufacture of beet-sugar have a dark-brown colour and viscous consistency, and possess an unpleasant taste and smell. They contain about 50 per cent of sugar, which will not crystallise out owing to the large quantity of foreign matter present. By treating these syrups with a hot saturated solution of strontium hydroxide and cooling, the greater proportion of the sugar separates in the form of strontium sucrate. This is collected, suspended in water, and treated with carbonic acid gas to precipitate the strontium in the form of its carbonate. The filtered solution is then worked up in the usual manner. The syrups which remain after the crystallisable sugar has been separated by the above process are generally fermented to produce alcohol, or worked up for the salts they contain. Loaf- or cube-sugar is made by pressing the washed *masse cuite* into moulds and cutting the thin slabs into pieces of the required size, which are then dried.

Cane- or beet-sugar (sucrose), when pure, crystallises in colourless four-sided prisms. It is very soluble in water, dissolving in one-third of its weight at ordinary temperatures, but is practically insoluble in alcohol and other solvents. On allowing a hot solution of sugar to cool gradually, large crystals may be obtained. Sugar-candy is prepared in this manner by stretching threads across the vat and allowing the crystals to grow on them.

A solution of sucrose rotates the plane of polarised light to the right, a property that is largely made use of in *saccharimetry*, i.e. the estimation of the amount of sugar present in a sample. Sucrose does not reduce Fehling's solution, or ferment, until it has been hydrolysed by acids or enzymes into a mixture of glucose and fructose. This decomposition is termed *inversion*, and the sugars obtained *invert-sugar*, owing to the fact that when the change has been completed the product is then lævorotatory. Sucrose melts at 160° C., solidifying on cooling to a pale-yellow glassy mass known as barley-sugar; at a higher temperature (205° C.) it loses water, and is converted into a brown substance termed caramel, which is used for colouring soups, gravies, beer, etc. Sugar is charred by concentrated sulphuric acid, with the formation of a black carbonaceous mass.

Sugar is valuable as a sweetening agent and forms an important article of food, being readily assimilated. It is rarely adulterated; in fact, loaf-sugar is almost chemically pure sucrose.

Statistics.—

World Production—Beet and Cane

In cwts.

1919-20	1920-1	1921-2	1930-1
304,000,000	332,000,000	320,000,000	527,000,000

World Production—Beet

U.S.S.R.	1,800,000	tons
Germany	1,600,000	,,
U.S.A.	1,100,000	,,
France	850,000	,,
Czechoslovakia	800,000	,,
Poland	490,000	,,

The World (roughly) 8,750,000

World Production—Cane

British India	3,900,000	tons
Cuba	2,750,000	,,
Neth. E. Indies	2,450,000	,,
Brazil	980,000	,,
Formosa	920,000	,,
Hawaii	860,000	,,
Porto Rico	860,000	,,
Philippines	860,000	,,

The World (roughly), 17,600,000

In Great Britain the tariff upon imported sugar has been greatly reduced in recent years :

Customs Receipts—Sugar

1928	£17,039,115
1929	13,911,816
1930	11,753,395
1931	12,363,749
1932	14,493,667

British Empire produce is either exempt or liable to a reduced rate, but of a total of 47,654,150 cwt. of sugar imported into Great Britain during 1932, only 14,092,331 cwt. were Imperial produce. Imperial dominions producing cane-sugar include India, Mauritius, Uganda, Natal, Australasia, and the West Indies. The following table shows the amount of sugar (in cwts.) imported into the United Kingdom from her Dominions for the years 1930-32.

great development, most of the sugar there being produced as jagree or crude sugar for native consumption, although refined sugar to the value of £71,233 was exported in 1931.

The sugar produced in the Imperial Dominions falls far short of even the United Kingdom demand, and the following table shows the source and total amount imported into Great Britain and Northern Ireland during the year 1931 :

Australia	535,682,336 lb.
Mauritius, etc.	346,747,184 ,,
Union of South Africa	279,401,024 ,,
Cuba	1,072,975,456 ,,
Peru	390,589,248 ,,
St. Domingo	338,738,960 ,,
Poland and Danzig	312,352,880 ,,
Germany	308,034,272 ,,
Other Countries	245,906,752 ,,
Total,	3,981,263,552

In the West Indies and in Louisiana, Texas, Hawaii, Porto Rico, the Philippines, San Domingo, Haiti, the Virgin

SOURCES	1930	1931	1932
Union of South Africa and South-West Africa Territory	2,148,741	2,494,652	1,000,794
Mauritius and Dependencies	2,719,003	3,095,957	3,920,556
Australia	3,726,391	4,782,878	2,038,430
British West India Islands, British Guiana, and British Honduras	1,617,480	1,346,745	1,031,152
Other British Countries	652,913	286,511	337,043
Total	10,864,528	12,006,743	6,190,281

In Canada (1932), 459,000 tons of beet-sugar were raised. East Africa generally is regarded as a suitable region for an Empire sugar-producing colony. In Australia cane-sugar raising is confined to Queensland and New South Wales, but Queensland leads on account of its immunity from frost, over 90 per cent of the total area under cultivation being devoted to sugar-cane ; in 1931 the acreage was 233,304 acres, and the yield 4,034,300 tons. The yield of made sugar amounted to 581,276 tons. In New South Wales the acreage was 15,624 acres, of which 7617 acres were cut for crushing, the yield being 160,209 tons. The sugar of Victoria is beet-sugar. In 1932 Australia exported sugar to the value of £2,514,750 (Australian currency).

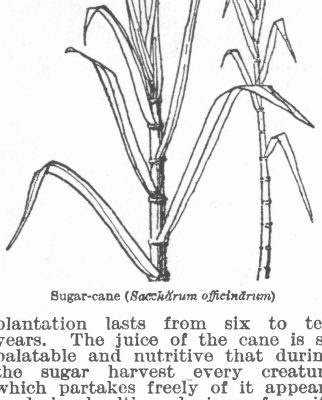
The principal industry of Mauritius is sugar, and its chief exports, sugar, molasses, and rum. In 1931 the total exports amounted to £1,787,688, of which £1,667,666 represented the value of sugar. The crop in 1932-3 was roughly estimated at 220,000 metric tons, as compared with 220,960 metric tons in 1930-1. Uganda and Kenya are capable of

Islands, Cuba, and the beet-growing parts of the United States, the sugar supply is protected.

Since the World War sugar-beet has become an important British crop. In 1927, 130,000 acres were under cultivation, over 1,100,000 tons of beet were delivered to the factories, and over 3,000,000 cwt. of sugar produced. In 1930 the acreage under cultivation was 315,000 acres. The sugar produced in 1930-1 amounted to about 423,000 tons, and in 1931-2 to about 250,000 tons. In Great Britain the beet-sugar industry has been fostered by a subsidy from the State, which in 1932-3 amounted to £2,400,000. In 1924 there were factories at Kelham and Colwick in Nottinghamshire, at Cantley in Norfolk, and subsequently at other places. The total number in 1930 was 19. The British Sugar Beet Society has its headquarters at 28 Westminster Palace Gardens, London, S.W.1.

SUGAR-CANE (*Sacchărum officinărum*). A plant of the nat. ord. Gramineæ or grasses, from which a great part of the sugar of commerce is obtained. It is nowhere

found in a wild state, but is probably a native of tropical Asia. It grows to the height of 7 or 8 feet or more, and has broad ribbed leaves and smooth shining stems. It is now cultivated in all the warm parts of the globe, such as the West Indies, Brazil, Java, etc., but varies in rapidity of growth according to the situation, the season, or the weather. The sugar-cane flowers only after the lapse of an entire year, and a



Sugar-cane (*Saccharum officinarum*)

plantation lasts from six to ten years. The juice of the cane is so palatable and nutritive that during the sugar harvest every creature which partakes freely of it appears to derive health and vigour from its use. For the process of making sugar, as well as for other information regarding this product, see the preceding article.

SUGAR CONVENTION. For many centuries the whole of the world's demand for sugar was met from the sugar-cane grown chiefly in tropical and, to a very small extent, in sub-tropical countries.

In the middle of the eighteenth century a German chemist succeeded in extracting sugar from beet-root grown in a temperate climate. The new industry was slow in establishing itself, and a hundred years later the proportion of beet-sugar was still very small. From 1850 onwards it increased very rapidly, and by the end of the century beet-sugar had assumed a preponderating place in the sugar trade of the world.

This rapid development was greatly fostered by the influence of tariffs. With the exception of Britain, which abolished the duty in 1874, most countries had long had import duties on sugar for revenue purposes, and when the new sugar industry assumed importance these duties were maintained and increased for protective reasons. At the same time, internal duties were levied upon the home-produced beet-sugar, but these duties were refunded to the producer on that part of the sugar which was exported. The internal tax took the form of a duty levied on the sugar-beet delivered to the sugar refiner, on the assumption of a given sugar content of the beet, but the drawback of duty was given on the actual amount of sugar exported.

Improvements in the process of refining led in time to a much larger proportion of sugar being extracted from a given quantity of beet, with the result that the operation of the drawback on exported sugar constituted in effect a heavy bounty on exportation. Great Britain, which was the chief sugar-importing country, found her markets flooded with cheap bounty-fed sugar, to the great detriment of the interests both of her sugar refineries and of her West Indian possessions, from which she had previously drawn large supplies of cane-sugar. The British consumer, of course, benefited, as also did the jam- and biscuit-making industries. The competition between the Continental countries producing beet-sugar led to continuous increases in the scale of export bounties, until the whole situation grew intolerable.

An attempt was made in 1888, at the instance of the British Government, to conclude an international convention to prohibit bounties on the export of sugar, but it proved impossible to reach agreement; and a similar fate befell a conference called by the Belgian Government in 1898. Finally, an agreement was reached which was embodied in the Brussels Convention of 1903, to which all the chief European Powers, with the exception of Russia, adhered. The signatory Powers agreed to suppress for five years all direct or indirect bounties favouring the export of sugar. In 1907 Russia became a party to the Convention on special terms, which, *inter alia*, contained the undertaking not to authorise the exportation of sugar in excess of 1,000,000 tons in any one year. In 1908 the Brussels Convention was extended for a further five years, but at the end of that period, in 1913, it was denounced by the British Government, owing to criticisms directed at some of the provisions, in particular, the limitation on Russian export, which it was held had caused sugar prices to rise.

The European War brought with it great changes in the world's sugar production. The output of beet-sugar fell off very greatly, while the production of cane-sugar increased, and regained its old position of predominance. Although the British Empire produces about one-fifth of the world's sugar supply, nearly the whole of this is grown in British India, which (*see* SUGAR) consumes the whole of its output. As a result, Great Britain is compelled to import from foreign countries practically the whole of her sugar supplies.

SUGAR-MITE (Glycyphagus). Species of mites frequently to be observed in raw sugar, very similar in appearance to the itch-mite.

SUHL (sōl). A town of Germany, in the Prussian province of Saxony. It is a mining centre, and has manufactures of porcelain, leather, chemicals, and fire-arms. Pop. 16,200.

SU'IDÆ. The family of mammals of which the hog is the type. This family is characterised by having on each foot two large principal toes, shod with stout hoofs, and two short lateral toes which hardly touch the earth. The canine teeth project from the mouth and curve upwards. The muzzle is terminated by a truncated snout, fitted for turning up the ground. The family includes the wild boar, the wart-hog, and the peccary.

SUIDAS. Greek lexicographer, of whom nothing is known except that he probably lived about the tenth century A.D. The dictionary which he compiled is an encyclopedic work; although it is unequal and badly planned, it is valuable for its literary history, its explanations of words, and its quotations from lost works. The quality of each article varies directly with that of its source. The dictionary has probably been re-handled several times, and one of its editors—though not necessarily Suidas—was a Christian.

SUIR, or **SURE.** A river rising in the Slieve-Bloom Mountains, Tipperary, Irish Free State. It forms the boundary between Tipperary and Waterford and Kilkenny, and after a course of about 100 miles it flows into Waterford harbour. It passes the towns of Cahir, Clonmel, and Carrick, and is navigable by barges to Clonmel.

SUKHUM. A seaport of Russia, in the Abkhasian S.S.R., Georgia, situated on the Black Sea. It has an open roadstead and quay, and is one of the ten chief electric power-stations in Caucasia. It is served by the railway line (now under construction) which runs along the shores of the Black Sea from Ak-hal Senaki to Tuapse. Pop. 62,000.

SUKKUR. A district and town of Sind, Bombay Presidency, India. The district has an area of 5580 sq. miles; pop. 574,000. The town is the headquarters of the district, and is an important strategic point on the North-Western Railway to Baluchistan, which crosses the Indus to Rohri by the Lansdowne Bridge at this point. Covering the approaches of the bridge there is a chain of forts, and the railway repair-shops are specially adapted for rifle defence. A scheme for utilising the waters of the Indus in the irrigation of the waste lands of Sind is known as the Sukkur Barrage, and was approved by the Indian Government in June, 1921. Pop. 42,759.

SULAIMAN HILLS. A mountain range of India, once the Indo-Afghanistan frontier, now the Punjab-Baluchistan boundary. The Kaisargharh has two peaks, 11,295 feet and 11,070 feet altitude respectively.

SULBY. Village of the Isle of Man. It is 20 miles from Douglas, and is known for the woollen goods which have been made here for a century. The industry was established by two Yorkshiremen. **Sulby Glen** is a beauty spot.

SULEIMAN PASHA. Turkish soldier, born 1838, died 1892. He was an instructor in the Military Academy at Stamboul, and came rapidly to the front during the Russo-Turkish War, when he commanded in Herzegovina. Although he was the hero of the defence of the Shipka Pass against the Russians (1877), his army of the Danube was defeated near Philippopolis, and he was degraded and condemned to imprisonment, but was soon pardoned by the Sultan.

SULGRAVE. Village of Northamptonshire, with a population of only about 400; it contains the old manor house occupied by the ancestors of George Washington. The house was bought by the British Peace Centenary Committee and presented to the **Sulgrave Institution** (offices, 1 Central Buildings, Westminster, S.W.1.), which, in 1914, opened it as a museum of Washington relics.

SULINA. A Danubian river-port of Rumania, at the mouth of the Sulina branch. It has a lifeboat-station, two lighthouses, workshops of the European Commission of the Danube, elevators for the loading and unloading of cereals and coal,

several big factories, and a quayage of about 2 miles for sea-going and river vessels. Pop. 5924.

The Sulina arm of the Danube, which is constantly dredged, is the only one of use for navigation. The delta is enclosed by the Kilia arm and the St. George arm, and the intervening mud-flats and marshes are traversed by the Sulina arm, navigable to Regensburg (Ratisbon) by barges of about 650 metric tons capacity. Sulina, the chief town on the delta, is only 2 feet above sea-level, and is built on piles, but the delta advances from 10 to 15 feet yearly, and is rapidly consolidating. Sulina is a great transshipment port for grain, etc.

SULIOTS. A mixed people of Albanian and Greek origin descended from Arnaout and Grecian shepherds, who, to escape the tyranny of the Turks in the seventeenth century, settled in the pashalik of Yanina (Albania), where they formed an independent republic (Suliote League), which struggled against Ali Pasha for eighteen years, and were dispersed by treachery in 1803, when Suli, their mountain fortress, was destroyed. They fled to the Ionian Isles, but later (1822) arrived in Greece and fought for Greek independence.

SULLA, Lucius Cornelius. Roman dictator, born in 138 B.C., died in 78. He received a good education, but was notorious from his youth upwards for his excessive dissipation and debauchery.

He served with distinction under Marius in the Jugurthine (107 B.C.) and Cimbrian (104-102) Wars, and in 93 was chosen prætor. For his services in the Social War (90-88) he was appointed consul (88 B.C.), and the province of Asia, with the conduct of the war against Mithridates, fell to his lot. Marius was also ambitious of this command, and resorted to acts of violence to carry his point, by which Sulla was compelled to escape from Rome. But Sulla re-entered the city at the head of his army, drove Marius to Africa, and then sailed for Greece at the beginning of 87 B.C. He expelled the armies of Mithridates from Europe (86), crossed into Asia (84), and was everywhere victorious, gaining plenty of wealth for himself and his soldiers, and forcing Mithridates to conclude a peace.

Marius had died in 86 B.C., after proscribing Sulla and confiscating his property, but the party of Marius was still strong. Sulla now hastened to Italy, and landed at Brundusium with 40,000 men (83 B.C.). He was joined by many of his friends who had been banished from Rome. He gained four battles over the Roman forces in person, and defeated a Samnite army under Telesinus. He entered the city victorious in 82, and immediately put to death between 6000 and 7000 prisoners of war in the circus. Rome and all the provinces of Italy were filled with the most revolting scenes of cruelty.

After satisfying his vengeance by the murder or proscription of thousands, he caused himself to be named dictator for an indefinite period (81 B.C.). He now ruled without restraint, repealed and made laws, abolished the tribuneship, and settled his veterans in various parts of Italy. In 79 B.C. he laid down his dictatorship, and, retiring to Puteoli, abandoned himself to all sorts of debauchery. — BIBLIOGRAPHY: Plutarch, *Life of Sulla*; Sir C. W. Oman, *Seven Roman Statesmen*.

SULLIVAN, Sir Arthur Seymour. British composer, born in 1842, died in 1900. His father was bandmaster at the Royal Military College, Sandhurst, from 1845 to 1856, when he became a professor at the Military School of Music at Kneller Hall, a post which he held until his death in 1866.

Sullivan was a precocious musician; at the age of twelve he was admitted one of the children of the Chapel Royal, and he composed an anthem and published a sacred song at the age of thirteen. In 1856 he won a scholarship at the Royal Academy of Music, where he was taught by Sterndale Bennet (q.v.) and Goss. He continued his studies at Leipzig from 1858 to 1861, and wrote his celebrated incidental music for *The Tempest*, which was performed at the Crystal Palace in 1862 with instantaneous success. This music brought Sullivan into the front rank of contemporary composers when he was barely twenty.

His earlier works include: a ballet, *L'Ile Enchantée*; a cantata, *Kenilworth*; the overture to an unfinished opera, *The Sapphire Necklace*; and the *In Memoriam* overture. In 1866 he began his comic opera career by writing the music of *Cox and Box*. The libretto was an adaptation by F. C. Burnand (q.v.) of Maddison Morton's farce. Burnand also wrote the libretto for *Contrabandista* (1867).

The ever-famous partnership with Sir W. S. Gilbert was inaugurated by the appearance of *Thespis, or the Gods Grown Old* (1871), but was not firmly established until the production of *The Sorcerer* (1877). (A full list of the operas written by Gilbert and composed by Sullivan will be found in the article GILBERT, Sir W. S.) These operas brought Sullivan fame and wealth, and it is

they which have endeared him to the vast majority of his admirers.

Sullivan's non-Gilbertian operas are: *Haddon Hall* (libretto by Sydney Grundy), *The Chieftain* (F. C. Burnand), *The Beauty Stone* (Pinero and Comyns Carr), *The Rose of Persia* (Basil Hood), and *The Emerald Isle* (Basil Hood), the last named being left unfinished, but completed by Edward German.

Sullivan also wrote a grand opera, *Ivanhoe* (Julian Sturgis), which ran for six months in 1891, but which never became popular. Sullivan's other works include: an overture, *Marmion*; an oratorio, *The Prodigal Son*; another oratorio, *The Light of the World*; a music drama, *The Martyr of Antioch*; and a setting of Longfellow's *Golden Legend*, considered by many his greatest work. He also wrote much church music of all kinds, including the well-known tune of *Onward, Christian Soldiers*; and many songs, of which perhaps the most popular was *The Lost Chord*. Sullivan never enjoyed good health, and died somewhat suddenly at the age of fifty-eight.

Sir Arthur Seymour Sullivan

Appreciation. Sullivan had an unrivalled gift of melody; everything that he wrote is good music. In his light operas he showed himself as great a musical humorist as Gilbert was a dramatic humorist. His treatment of the wood-wind instruments is especially masterly. Yet even in his most apparently irresponsible passages he displays a reverence for art; his music is always scholarly and never pedantic. Some critics have found fault with him for squandering upon light opera the fertility and technical resource which he might have devoted to serious opera like *Ivanhoe*. It is doubtless to be regretted that Shakespeare did not employ his legal talents in writing a *Commentary on the Laws of England*, and that Molière did not utilise his undoubted dramatic gifts in writing a good heavy tragedy instead of a series of farcical and sometimes nonsensical comedies. The Savoy operas have given pleasure to thousands; they have satisfied Victorians, Edwardians, and Georgians alike; and their fame and that of Sullivan will not easily pass away.

SULLY, Maximilien de Béthune, Duc de. French statesman, son of the Baron de Rosny, born 1560, died 1641. He was a Protestant (Calvinist), and, having attached himself to the court of Henry of Navarre (1571), he fought in the civil wars, escaped the massacre of St. Bartholomew, and assisted Henry generally in combating the League. In 1597 he became Surintendant des Finances and practically first minister of State.

He was one of the great statesmen of France, concentrating on finance, palliating the burden of taxation, while increasing the State income from seven to sixteen millions by the abolition of tax-farming, and paying off an enormous State debt. Manufacturing industries were discouraged by Sully, who proclaimed tillage and grazing to be "the two breasts of France." In 1606 Sully-sur-Loire was erected into a duchy for him, and, after the murder (1610) of Henry IV. (q.v.), he retired to his seat. Richelieu created him marshal in 1634. Sully's *Mémoires* (1638-62), which were translated into English (1756 and 1786), are valuable, but unpleasant and untrustworthy.

SULPHATES. The salts of sulphuric acid. Sulphuric acid is a dibasic acid, and gives rise to two distinct series of salts, viz. the *normal* or *neutral* sulphates, in which the whole of the hydrogen of the acid is replaced by metallic radicles, e.g. Na_2SO_4 and $ZnSO_4$; and *acid* sulphates (or bisulphates), in which only part of the hydrogen of the acid has become replaced, e.g. $KHSO_4$ and $NaHSO_4$. Most of the sulphates are readily soluble in water. Gypsum, or calcium sulphate, $CaSO_4$, $2H_2O$, is sparingly soluble, and barium and lead sulphates are insoluble.

Some of the commoner sulphates are: alum, or double sulphate of aluminium and potassium; am-

monium sulphate, obtained in gas-works, and used as a source from which other ammonium compounds are prepared; blue-vitriol, or cupric sulphate, $CuSO_4$, $5H_2O$, used in surgery, in dyeing, and for preparing green pigments; green vitriol, or ferrous sulphate, $FeSO_4$, $7H_2O$, used for making ink, and in dyeing and calico-printing. Epsom salts, $MgSO_4$, $7H_2O$; Glauber's salts, Na_2SO_4, $10H_2O$; white vitriol, $ZnSO_4$, $7H_2O$, used in surgery, also in the preparation of drying oils for varnishes, and in the reserve or resist pastes of the calico-printer; quinine sulphate, used in medicine; and mercuric sulphate, $HgSO_4$. Numerous double sulphates besides alum are known.

SULPHONAL $(CH_3)_2C(SO_2C_2H_5)_2$. A drug used as a hypnotic. It is manufactured by condensing acetone $(CH_3.CO.CH_3)$ and ethyl mercaptan $(C_2H_5.SH)$ in the presence of zinc chloride, and oxidising the resulting mercaptol, $(CH_3)_2C(SC_2H_5)_2$, by potassium permanganate. Sulphonal occurs in the form of colourless, odourless, and almost tasteless prismatic crystals, or as a white crystalline powder. It is very stable, and little affected by acids, alkalis, or oxidising agents. Its hypnotic action is due to its easy solubility in brain lipoid, and its insolubility in water. It is useful in simple insomnia unaccompanied by pain, but must only be used occasionally.

SULPHUR (symbol, S; atomic weight, 32). A non-metallic element which occurs in the free state chiefly in volcanic districts. The most important sulphur-bearing regions are in Sicily, Italy, Japan, the United States, and Iceland. In combination with other elements sulphur is widely distributed, occurring in the sulphates, gypsum (calcium), heavy spar (barium), Epsom salts (magnesium), and also in the sulphides, pyrites (iron, copper, arsenic), blende (zinc), galena (lead), cinnabar (mercury), and stibnite (antimony). These compounds, however, are not convenient sources of sulphur.

Native sulphur usually occurs in large deposits and veins contaminated with stones and other impurities, and is obtained from the mixture by melting. A large heap which may contain up to 2000 tons of sulphur stone, is built up on sloping ground and covered with the residue from a previous melting and finally with clay, air-holes being left at the top of the stack. The heap is then ignited and the lower opening of the furnace almost closed, so that the combustion proceeds very slowly through the heap. Some of the sulphur is burnt to sulphur dioxide, but the greater part is melted by the heat and trickles down into moulds placed at the bottom of the slope. The melting process takes from one to three months, according to the quantity of material. By the use of superheated steam, the melting can be performed more economically and without the production of sulphur dioxide, which causes great injury to the surrounding vegetation.

A large quantity of sulphur is recovered from the waste calcium sulphide of the Leblanc soda process by Chance's method. The moist material is decomposed with lime-kiln gases (carbon dioxide) producing sulphuretted hydrogen. This gas is then burnt in a special furnace with a definite quantity of air, corresponding to the equation $2H_2S + O_2 = 2H_2O + 2S$, the sulphur fumes being condensed in chambers. Crude sulphur is purified by slow distillation from retorts into brick-work chambers, when the sulphur vapour condenses and forms a powdery deposit, the "flowers of sulphur" of commerce. If the distillation is carried to a pale-yellow liquid, which is cast into wooden moulds, forming "roll sulphur."

Sulphur exists in four allotropic modifications: the octahedral or rhombic, the prismatic or monoclinic, the plastic, and the amorphous variety. Native and roll sulphur consist of the octahedral variety, which may be obtained in large crystals from its solution in a solvent. It melts at 115° C. to a mobile amber-coloured liquid. Prismatic sulphur, which is only stable above 96° C., is obtained by melting the ordinary variety and allowing it to cool slowly. Plastic sulphur may be prepared by pouring molten sulphur, heated to a temperature of about 400° C., into water, when a tough rubber-like substance is obtained, which in a few days becomes hard and is transformed into the octahedral variety. Amorphous sulphur is precipitated when hydrochloric acid is added to a solution of sodium thiosulphate. The two crystalline forms of sulphur readily dissolve in carbon bisulphide, benzene, turpentine, etc., whereas the plastic and amorphous varieties are insoluble.

On heating, all forms of sulphur melt to an amber-coloured liquid; on raising the temperature, the liquid turns redder and becomes more viscous, until at 230° C. it is almost black, and cannot be poured from the vessel containing it. On still further raising the temperature, it regains its mobility, and finally

boils at 445° C., with the evolution of reddish-brown fumes. On cooling, these changes take place in the reverse order. Sulphur readily burns in air, forming sulphur dioxide; it combines directly with many metals, e.g. iron, copper, mercury, etc., and with non-metals, e.g. iodine, carbon, hydrogen, etc., with the formation of the corresponding sulphides.

Sulphur is chiefly employed for the production of sulphur dioxide, used in the manufacture of sulphuric acid (q.v.), sulphites, etc., and also as a fumigating and bleaching agent. Sulphur is largely used for vulcanising caoutchouc and gutta-percha (*see* RUBBER); it is also a constituent of gunpowder and pyrotechnic mixtures. In medicine it is used externally as a parasiticide, and internally as a mild aperient.

SULPHUR BACTERIA. A common name for several kinds of bacteria which have the remarkable property of making use of sulphuretted hydrogen—a gas highly poisonous to most organisms—as a source of energy; they store up granules of sulphur in their cells, afterwards oxidising these to sulphates. *Beggiatoa*, which consists of slender unbranched filaments, is one of the best-known.

SULPHUR DIOXIDE, or **SULPHUROUS ANHYDRIDE,** SO_2. A gas formed by the combustion of the element sulphur in air or oxygen. It is a colourless gas at ordinary temperatures, has a suffocating odour, and is readily soluble in cold water, forming an acid solution containing the unstable acid *sulphurous acid*, H_2SO_3. It is easily liquefied, either by pressure or by cooling it to —18° C. at ordinary pressure. The liquid is now an article of commerce, and is placed on the market in glass siphons.

Sulphur dioxide in presence of water bleaches many colouring-matters, and is used in bleaching woollen goods, straw, and silk. It is also used as an *antichlor* to remove chlorine from paper, etc., which has been whitened by bleaching-powder. It acts as a strong reducing agent, as it is readily oxidised to sulphuric acid. Sulphur dioxide or its solution is useful as an antiseptic, as it arrests fermentation; it is also used in fumigating clothes and disinfecting the air of rooms. It is manufactured in enormous quantity from iron pyrites for the preparation of sulphuric acid.

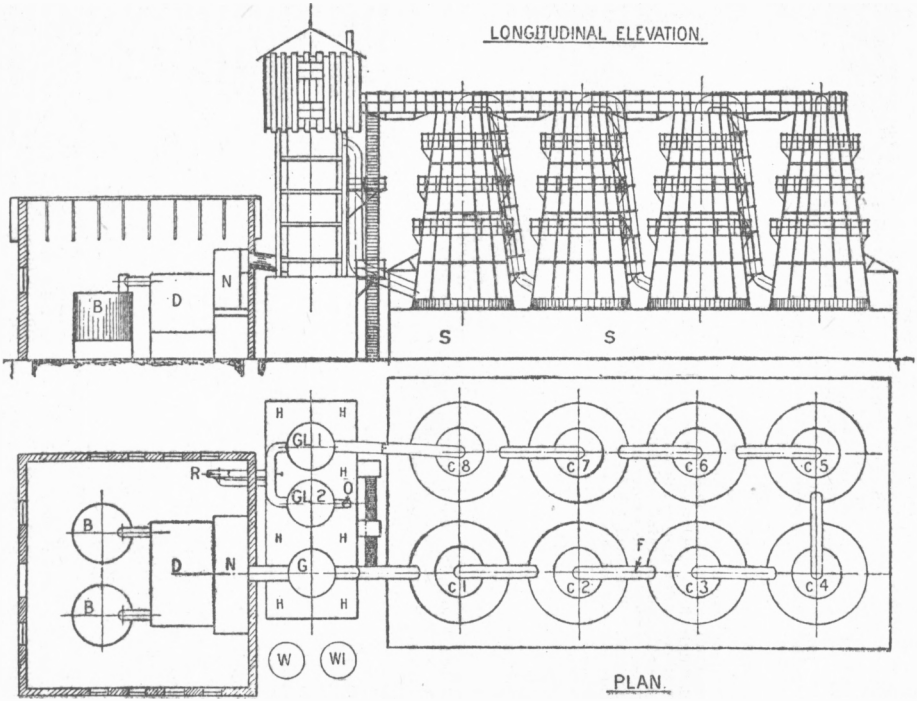
SULPHURETTED HYDROGEN, or **HYDROGEN SULPHIDE,** H_2S. A compound formed when sulphur is burnt in hydrogen gas. It is usually prepared by decomposing ferrous sulphide (FeS) by means of dilute hydrochloric or sulphuric acid. It is a colourless, poisonous gas with an unpleasant odour resembling that of rotten eggs; it is heavier than air, and burns in air with the formation of water and sulphur dioxide. It occurs naturally in certain mineral springs, such as those at Harrogate, and is produced whenever animal or vegetable substances containing sulphur decompose. It is formed during the distillation of coal, and is therefore present in coal-gas before it is purified.

The substance is a strong reducing agent, a weak acid, and forms a series of insoluble salts, the sulphides, of distinctive colour; on this account it is used largely as a reagent in analytical chemistry. The gas or its solution is easily identified by its odour, by the black stain it produces in coming in contact with a solution of lead acetate, and by the violet coloration produced when even a minute quantity of the solution is mixed with an alkaline solution of sodium nitroprusside.

SULPHURIC ACID, or **OIL OF VITRIOL** (H_2SO_4). Prepared almost exclusively by one of two methods, namely, the "chamber" process or the "contact" process. In both cases the acid is formed by the oxidation of sulphur dioxide (SO_2) to sulphur trioxide or sulphuric anhydride (SO_3), which in the presence of water is immediately converted into sulphuric acid, $H_2O + SO_3 = H_2SO_4$. This oxidation, however, only takes place in the presence of a catalytic agent (*see* CATALYSIS).

The chamber process, first used in 1746, depends on the oxidation of sulphur dioxide by air, in the presence of nitrogen peroxide and water. The chemistry of the process is not thoroughly clear, and much discussion has taken place as to the stages in which the various reactions occur. The final result, however, may be expressed by the formula $H_2O + SO_2 + NO_2 = H_2SO_4 + NO$. The nitric oxide formed is reoxidised by means of air to nitrogen peroxide, which can then convert a further quantity of sulphur dioxide into sulphuric acid.

The manufacture is carried out as follows. Iron pyrites is roasted in kilns with a regulated supply of air, whilst in the flues are placed earthenware pots charged with sodium nitrate (Chile saltpetre) and sulphuric acid. The hot gases, containing about 7 per cent of sulphur dioxide, pass over these vessels and become mixed with the nitric acid fumes liberated from them. Part



Plan and Elevation of Sulphuric Acid Plant. (By permission of Messrs. Packards & James Fison (Thetford), Ltd., Ipswich.)

B, Mechanical pyrites burners. D, Dust Chamber. N, Flue from dust chamber to Glover tower and nitre oven. G, Glover Tower. C1 to C8, Chambers (Mills-Packard). F, Connection Pipes. GL, Gay-Lussac towers. R, Regulus metal fan. S, Space under chambers. W and WI, Coolers. O, Chimney.

of the sulphur dioxide becomes oxidised at this point by the nitric acid, but the greater proportion passes on up a *Glover tower*, which is lined with lead plates and loosely filled with flints or some other acid-proof material. Crude sulphuric acid containing dissolved oxides of nitrogen (see below) is allowed to trickle down this tower, the descending stream thus meeting the hot gases from the pyrites burners, which pass upwards through the tower, and then into leaden chambers. The gases, which have thus been cooled and which contain sulphur dioxide, air, and nitric oxide, now come in contact with sprays of steam or fine jets of water. These chambers are made of sheets of lead welded together and supported by wooden frames. It is here that the main reaction takes place, the dilute sulphuric acid formed collecting at the bottom. After passing through two or more such chambers, the residual gases are passed upwards through a Gay-Lussac tower filled with coke, down which flows a stream of cold concentrated sulphuric acid, which absorbs the oxides of nitrogen present. The acid which collects at the bottom of the tower, together with the chamber acid which also contains oxides of nitrogen, is then pumped up to the top of the Glover tower. The process is thus continuous, and the oxides of nitrogen are used over and over again, but in practice a certain proportion is lost owing to other reactions taking place. This loss is made up by the small but constant supply from the nitre pots. As a rule about 3 or 4 parts of sodium nitrate are required for every 100 parts of sulphur burnt in the form of pyrites.

The Glover tower serves three purposes: besides removing the dissolved oxides of nitrogen from the chamber acid and that which collects at the bottom of the Gay-Lussac tower, it cools the furnace gases from a temperature of about 300° C. to 60° C., and it finally serves to concentrate the chamber acid. At the same time, a certain proportion of sulphuric acid, apart from that which is generated by *denitration*, is actually formed in the Glover tower by the reaction between the sulphur dioxide and the oxides of nitrogen liberated from the acid which flows down the tower. The acid which collects at the bottom of the Glover tower has a specific gravity of about 1·73, and contains 80 per cent of sulphuric acid; some of this is pumped to the top of the Gay-Lussac tower, but the greater part is collected and may be used in this state for many technical purposes, e.g. in the Leblanc soda process, for the manufacture of superphosphate of lime, etc. For other purposes it is often necessary to remove impurities, such as arsenic, lead, and nitrous acid, which are always present in small quantities. The crude or the purified acid may be concentrated to 98 per cent (specific gravity, 1·84) by heating in shallow lead pans and finally in glass, porcelain, or platinum dishes, but as a rule the concentration is not carried further than about 93 to 95 per cent.

In addition to pyrites, sulphur or sulphuretted hydrogen, prepared from the alkali waste of the Leblanc soda process, is used for the production of sulphur dioxide. The acid thus formed is free from arsenic and other impurities which are present in pyrites. Pure anhydrous sulphuric acid may be obtained by freezing the 98 per cent acid and collecting the crystals, but is more conveniently prepared by the process which will now be described.

The contact process owes its origin to the work of Winkler, who showed that a mixture of sulphur dioxide and oxygen combines under the influence of finely divided platinum to form sulphur trioxide, which is immediately converted into sulphuric acid on treatment with water. Other substances, such as oxides of iron and vanadium, may be used in place of platinum, but are not so satisfactory.

On the manufacturing scale, sulphur dioxide containing excess of air is prepared by burning pyrites or other sulphur-containing substances as before. The gases are then purified, especially from dust and arsenic, which seriously interfere with the action of the platinum catalyst. They are then dried with concentrated sulphuric acid and passed into the contact chamber, which contains platinised asbestos. The reaction here takes place with evolution of heat; the temperature is prevented from rising above 450° C. by external cooling. The sulphur trioxide formed is then absorbed in dilute sulphuric acid until the desired strength is obtained. By this means it is possible to prepare an acid containing any desired percentage of sulphur trioxide.

The contact process is principally employed for the preparation of the 100 per cent acid, or the fuming variety, which contains excess of sulphur trioxide. This is extensively used for the production of explosives, and intermediate products for dye manufacture. In cases where a weaker and less pure acid is required,

the chamber process is still the most suitable.

Fuming sulphuric acid, also known as Nordhausen, or pyrosulphuric acid, $H_2S_2O_7$, was originally obtained by the distillation of partially oxidised ferrous sulphate in clay retorts. It forms a colourless fuming liquid. Pure sulphuric acid, H_2SO_4, is a colourless, oily liquid without odour. It possesses a great affinity for water, and for this reason it is used as a desiccating agent, e.g. for drying gases. When the pure acid is poured on to wood, sugar, or many other substances of organic origin, it abstracts the elements of water, leaving a black carbonaceous residue. Sulphuric acid should always be diluted by pouring it in a thin stream into water, and not conversely, or violent ebullition will take place. Sulphuric acid is employed in a very large number of manufacturing processes, in fact it is one of the most important substances in technical use. Chemically, it acts as a dibasic acid, forming both normal and acid salts, the sulphates (q.v.).

SULPHURIC ESTERS. Compounds formed by replacing one or both hydrogen atoms of sulphuric acid by alkyl groups. For example, ethyl hydrogen sulphate, $C_2H_5HSO_4$, and diethyl sulphate, $(C_2H_5)_2SO_4$, are both esters of sulphuric acid, H_2SO_4. Diethyl sulphate is a colourless, poisonous liquid used for the introduction of ethyl groups into organic compounds.

SULPHURIC ETHER. Another name for ordinary ether $(C_2H_5)_2O$. (For a short account, *see* ETHER.) Its density is 0·722; specific heat, 0·53: boiling-point, 35° C.; freezing-point, −117° C.; and index of refraction, 1·35. It is prepared by heating one part of concentrated sulphuric acid and two parts of ethyl alcohol in a distilling flask fitted with a condenser. Ether distils over when the mixture reaches a temperature of 140° C. It is collected in a cooled receiver, washed free from alcohol, dried, and redistilled. Ether is slightly soluble in water, and water is slightly soluble in ether, so that when ether and water are mixed the ether usually separates as a layer on the top of the denser water. On this account it is much used for separating organic substances from aqueous solutions, as they are usually much more soluble in ether than in water, and a small amount of ether can remove a considerable quantity of substance from a large volume of water.

Ether is a valuable solvent for many organic substances, such as acids, hydrocarbons, phenols, oils, resins, etc., and for certain non-metals. It is used as a solvent for collodion in photography. It has anæsthetic properties, and is sometimes used instead of chloroform, or mixed with chloroform. It is employed also as a local anæsthetic for minor operations, as it takes up much heat during evaporation and so produces local freezing.

Ether is the best known of the class of organic compounds known as *ethers*, and consisting of two alkyl or aryl groups linked by one atom of oxygen; examples of these are *methyl ether*, $CH_3{\cdot}O{\cdot}CH_3$; *phenyl ether*, $C_6H_5{\cdot}O{\cdot}C_6H_5$; and *phenyl ethyl ether* or *phenetol*, $C_6H_5{\cdot}O{\cdot}C_2H_5$.

SULPHUR-ORE. A name often given to the mineral iron pyrites (q.v.).

SULTAN. The ordinary title of Mahommedan rulers since the time of the Ghaznivid Mahmud (997-1030). The ruler of Turkey assumed the title of *Sultan-es-selatin*, "Sultan of sultans." The older English word, used by Scott and others, is Soldan.

SULTANPUR. A district and town of the United Provinces, India. The district is traversed by the Gumti, and is served by the Oudh and Rohilkhand Railway. Native food-grains, rice, and sugar-cane are the staples. The town, on the Gumti, and served by a branch of the railway, is the district headquarters. It occupies the site of old cantonments, and has good grain markets. Area (district), 1713 sq. miles; pop. 1,003,912; pop. (town), 9500.

SULU. An archipelago of over 400 Pacific islands, forming one of the forty-eight provinces of the Philippines. The larger islands are volcanic, and the smaller coralline. The total area is 1550 sq. miles; pop, 120,000. Pearl-shell, indigo, teak, rice, coffee, and cotton are among the productions. Sulu, on Sulu Island, is the capital.

SUMACH (sū′mak; Rhus). A genus of shrubs of the nat. ord. Anacardiaceæ, with pinnate leaves and small flowers. They all have a lactescent acrid juice, and most of them possess valuable tanning properties.

Species. More than seventy species are known. *R. coriaria* is found in the countries about the Mediterranean. Its roots contain a brown, and its bark a yellow dye. The leaves and seeds are used in medicine as astringent and styptic, and the

leaves are exported for use in tanning, dyeing, and calico-printing. *R. typhina* is an American species with hairy branches, hence its common name of stag's-horn sumach. It produces small red berries, and is cultivated in European gardens for ornament. *R. glabra*, another American species, is also grown for ornament, and its berries and branches are used for dyeing purposes. *R. venenata*, commonly called dogwood or poison sumach, is a shrub of the American swamps. It grows from 12 to 20 feet high, and produces greenish-white flowers. It is extremely poisonous, in some cases giving rise to inflammation of the skin, followed by a pustular eruption. *R. radicans*, often called poison ivy, is a climbing variety. It affects certain individuals in the same manner as the poison sumach, but it is less virulent. The leaves of several of these species are now extensively collected in America for tanning or other purposes. The celebrated Japan varnish is obtained from a species of Rhus with downy and velvety leaves. The varnish oozes from the tree when wounded, and grows thick and black when exposed to the air. For currier's sumach, *see* CORIARIA.

SUMATRA. An island of Malaya, one of the Dutch East Indies (q.v.), marking the easternmost extremity of the Malay Archipelago. It lies across the equator, and is separated by the Straits of Malacca from the British-Malayan mainland. Sumatra and Java (q.v.) are physically similar; but Sumatra, although three times as large as Java, supports a smaller population, and is less fertile and not so highly developed. The backbone of the island is a high volcanic mountain chain falling on the north-east and south-west to coastal plains.

Productions and Minerals. Maize, camphor, tobacco, and black pepper are produced, together with those commodities mentioned under *Java*. Minerals include: gold (from near Jambi and Palembang), coal (in the Padang Highlands), magnetite and copper ore (Central Highlands), and tin (Siak Valley, Banca, and Billiton Islands, etc.).

Towns. Padang is the chief port; Deli (tobacco centre), Palembang (Musi River; coffee, rubber, and black pepper exporting centre), Telok-Betong, and Sabang—a new and fully equipped port and coaling-station on the north-west of the island (Malacca Straits), sheltered behind the Island of Weh—are the chief towns. Area, 163,138 sq. miles; pop. 7,604,974.

SUMBA, or SANDALWOOD. An island, the third in size, of the Lesser Sunda group, Dutch East Indies. It has a low and sandy northern coast and a precipitous southern seaboard; the hinterland rises in flat terraces from the coasts. Of rivers only the Kambera is navigable (for about 1 mile). Waingapu (pop. 1000) is the chief town. Maize is the staple, and the sandalwood, which gave the island its original name, has almost disappeared through haphazard clearance. Sumba horses are the best in the Dutch East Indies for size and strength. Tobacco, cotton, rice, and indigo are raised, and sago is exported.

The Dutch East India Company were shipping sandalwood from Sumba in the seventeenth century, and the island was also a slaving centre. Later, trouble with the natives led to the abandonment of the company's interests, and in 1866 the first Dutch officials took up their duties. Area, 4600 sq. miles; pop. 200,000.

SUMBAL, or SUMBUL. An Eastern name for the root of an umbelliferous plant, *Euryangium sumbul*. It contains a strongly odorous principle, like that of musk, and is regarded as an anti-spasmodic and stimulating tonic. Also an Eastern (Arabic) name of spikenard (q.v.).

SUMBA'WA. An island of the Dutch East Indies (Lesser Sunda Islands). It comprises several native states, tributary to the Timor Residency. Bima (pop. 2000) is the port and largest town; the Bay of Bima, 16 miles long, is one of the finest in the Dutch East Indies. Sumbawa and Maumere (a port) are other towns. Sulphur, arsenic, and petroleum are found; cinchona, bees'-wax, tobacco, saponwood, rice, and teak are produced; and buffaloes, horses, goats, and sheep are exported. The three towns have a trade with the Celebes and Java. Sumbawa is mountainous, and in the north is the volcano Temboro (7600 feet altitude). The inhabitants are Mahommedan-Malays. Area, 5362 sq. miles; pop. 182,354.

SUMERIAN. *Shumer*, a Babylonian word occurring in the cuneiform inscriptions, is possibly equivalent to the Heb. *Shin'ar* = *Sennar*, and it is certainly the *Shinar* of the Old Testament, Shinar and Shumer (Sumer) being synonyms for Babylonia. Shinar is mentioned in Gen. x., 10 as possessing four chief cities, Babel (Babylon), Erech, Accad, and Calneh, and it is also mentioned in Gen. xi., 2, and xiv., 1, 9. In Is. (xi, 11) and in Zech. (v., 11) the word occurs once only in each

book, when it is an obvious archaism, and is rendered by the *Septuagint* as "Babylonia" and "land of Babylon" respectively. The geographical use of the term lapsed possibly after the time of Moses.

Of many problems connected with the Sumerians, the study of none of them has been attended by so much difficulty as the philological, for the Sumerian language was greatly influenced by grammatical Semitisms, although probably not itself a Semite language; but supporters of Halévy's postulate are convinced that the so-called Sumerian language is not a language but a cryptography, based upon the Semitic speech of the day, and used in the temples by the priestly caste. *See* UR.

SUMMARY PROCEEDING. In law, said of a form of trial in which the ancient established course of legal proceedings is disregarded, especially in the matter of trial by jury. In no case can a party be tried summarily unless when such proceedings are authorised by legislative authority, as in a committal or contempt of court, the conviction of a person by justices of the peace, etc.

SUMMER. The season of the year which in the northern hemisphere generally may be said to comprise the months of June, July, and August. The astronomical summer lasts in the northern hemisphere from the June solstice to the September equinox. During summer the sun, being north of the equator, shines more directly upon this hemisphere, and is above the horizon for a longer proportion of the time, which renders this the hottest period of the year. The period of greatest heat generally takes place in July, since the influence of the sun's rays has then produced an accumulated effect on the earth. In the southern hemisphere the astronomical summer lasts from the December solstice to the March equinox.

SUMMER-DUCK (*Aex sponsa*). A species of duck, allied to the mandarin duck or Chinese teal (*A. galericulata*), and distinguished as a genus by a short bill with a large horny tip and straight edges, and by the hinder toe being unconnected to the other digits. These birds inhabit North America, and usually build their nests in the hollows and trunks of trees. The summer-duck has been found capable of domestication.

SUMMERSIDE. A town of Prince County, Prince Edward Island, Canada, on Northumberland Strait; served by the island railway. Beef-packing, lobster-packing, flour-milling and the making of rolled oats and threshing-machines are progressive industries. The town is the centre of a fox-ranching industry. Pop. 3759.

SUMMER TIME ACT. Act of the British Parliament providing for an extension of daylight between spring and autumn by the simple expedient of advancing the hands of the clock by one hour ahead of Greenwich time on a specified date in spring, and setting them back by one hour on a specified date in autumn.

The originator of this scheme of "daylight saving" was William Willett, a builder in London, who advocated it vigorously, but died in 1915 before its adoption. In 1909 a Daylight Saving Bill had been introduced in Parliament, but it was dropped, and it was the exigency of war that brought the scheme again to the front as a means of saving light and fuel. The Summer Time Act, 1916, was therefore passed, and by it Greenwich mean time was advanced one hour on 21st May and restored on 30th September in that year. The main opposition came from the farmers, but it was found when Summer Time was actually put into practice that their difficulties had been much exaggerated. The scheme on the whole proved popular, and was kept in force in each succeeding year till in 1925 a law enforcing the adoption of Summer Time was passed.

By an Act passed on 20th July, 1922, it was specified that the Summer Time period should begin at 2 o'clock in the morning of the day following the third Saturday in April, or, if that Sunday be Easter Day, the day following the second Saturday, and that Summer Time should end at 2 o'clock in the morning of the day following the third Saturday in September. The Act was renewed in 1924 and 1925, and was made permanent on 7th August, 1925, the only modification being the substitution of the first Saturday in October for the third Saturday in September. Great Britain, Northern Ireland, the Channel Islands, and the Isle of Man come under the scope of this Act. In the United States Summer Time has been intermittently tried, and in France and Belgium holds good for the same period as in England. Australia adopted, but later abandoned, the scheme.

SUMMONS. In law, a writ, addressed to the defendant in a

personal action, admonishing him to appear in court. It must contain the names of all the defendants, the name and address of the person taking it out, and the date of issue, and must be endorsed with a statement of the nature of the claim to be made or the remedy required. A summons should be served on the defendant in person; but if reasonable efforts are made to do this, and the defendant is aware of its issue, the judge may authorise the plaintiff to proceed in the action without personal service, or may order substituted service. Service is dispensed with if a defendant through his solicitor agrees to accept service and enters appearance.

The law of Scotland requires a summons to contain the grounds and conclusions of the action. It is issued from the Court of Session in the sovereign's name, but in an inferior court it is issued in the name of the judge or magistrate presiding over that court. Most initial writs in actions in the inferior civil courts are now, however, in the form of "petitions," upon which the court endorses a warrant requiring the defender to appear and answer, the forms of summonses being still retained only in actions not exceeding £20 in value.

SUMNER, Charles. American jurist and politician, born 1811, died 1874. Educated at Harvard University, he was called to the Bar, and became reporter of the United States Circuit Court. Between 1844 and 1846 he edited and published *Vesey's Reports*, in twenty volumes. In 1851 he was elected to the Senate, and championed the emancipation of slaves. In 1861 he became chairman of the Senate committee on foreign relations. He opposed both the policy of President Johnson and the home and foreign policy of President Grant.

SUMNER, John Bird. British divine, son of a clegyman, born 1780, died 1862. Educated at Eton and Cambridge, he entered the Church and became rector of Mapledurham. In 1820 he was made Canon of Durham, in 1828 Bishop of Chester, and in 1848 Archbishop of Canterbury. His works include: *The Evidences of Christianity* (1824), *Lectures on the Gospels and Epistles* (1831-40), and *Practical Reflections* (1859).

SUMPTUARY LAWS, or legislation to restrain extravagant living, can be found in many ages and countries. Such enactments were a common expedient in Greece and in Rome, and they are found in mediæval Europe. In the fourteenth century, for example, the English Parliament regulated the number of courses at dinner and the wearing of foreign cloth, furs, or silk. Some of these enactments were intended, in the first place, for the encouragement of native manufactures, and this motive remained after the legislators lost faith in the practicability of enforcing purely sumptuary statutes. Thus, while in seventeenth-century England sumptuary laws were repealed, royal proclamations and parliamentary statutes ordered the burial of corpses in woollen grave-clothes in order to encourage the wool trade and to discourage imported linen. These laws continued in force until 1815. In Scotland, on the other hand, new sumptuary laws were passed in the seventeenth century to restrict expenditure on mournings and on funeral feasts.

In modern times the only relics of such legislation are to be found in the small taxes imposed upon the use of armorial bearing, etc., and in the heavy duties on spirits, wines, and tobacco. The difficulty of organising a system of taxation on luxuries was illustrated by the unsuccessful efforts in this direction made in 1917-8, as a part of the policy of restriction of imports, necessitated by the European War. A proposal to this effect was adopted in France, and was carefully considered by Mr. Bonar Law in framing his Budget of 1918. He appointed a Select Committee to frame a schedule of "luxuries," but the project had to be abandoned.

SUN. The central body of the system to which the earth belongs. Its diameter is 867,000 miles, or 109 times that of the earth. Thus it exceeds the earth in volume about 1,300,000 times, but in mass about 330,000 times, as its mean density is only 1·4 times that of water, or one-fourth of the earth's. Its axis of rotation is inclined 7° to a normal to the ecliptic, towards that position which the earth occupies at 7th September. Observation of sun-spots and spectroscopic observations show that the rotation period varies in different latitudes, being about 24½ days at the equator, and 33 days in latitude 75°. Thus the sun does not rotate as a solid body. This fact, as well as its low density, indicates that it is largely in a fluid condition.

Viewed in the telescope the sun's surface presents a mottled texture, with minute bright parts or *granules*, and dark parts or *pores*. These are in a constant state of rapid flux and change. There are larger bright portions or *faculæ*, and dark portions or *spots*, the latter of all sizes up to

tens of thousands of miles in extent. Spots also are evanescent phenomena. They often appear in groups or trains, frequently with two large members and many smaller ones. The different degrees of shade in a spot are distinguished as nucleus, umbra, and penumbra. Spots may last only a few days, but large ones may persist for weeks, and thus be seen in several successive solar rotations. They appear mainly in two zones of latitude north and south of the equator. Sunspots wax and wane in numbers in a period of about eleven years. Electric particles seem to be shot out from spotted areas, which affect the magnetic state of our globe, as the passage of large spots is frequently attended by magnetic storms and aurorœ. Records of terrestrial magnetism and aurorœ also clearly exhibit the same eleven-year periodicity.

The luminous exterior of the sun which radiates its light is called the *photosphere*. Over this is a thin shell of cooler gases called the *reversing layer*, which absorbs some of the light, and causes the dark lines in the solar spectrum. Above this is the *chromosphere*, or sphere of colour, a region 5000 to 10,000 miles deep, glowing with reddish light, which is seen in total eclipses around the dark limb of the moon. Its appearance has been compared to a prairie on fire. It is in a state of commotion, rising at places into *prominences*, or *red flames*, which are projected to tens, or, in exceptional cases, to hundreds of thousands of miles. "Eruptive prominences," consisting mainly of metal elements, undergo great changes in the course of hours, or even minutes, but "quiescent prominences," composed mostly of hydrogen and helium, float like clouds in our atmosphere. Formerly prominences could be seen only at total eclipses; now they are continuously under observation by spectroscopic methods.

Farthest out of all is the *corona*, or sun's outer atmosphere, very greatly exceeding in bulk all the rest of the sun. It can be seen only at total eclipses, and can be observed, without any instrumental aid, as an aureole of pearly light surrounding the dark moon. It is of very tenuous structure, as comets have passed through it with no appreciable resistance. Its spectrum shows the presence of hydrogen, and of a gas unknown terrestrially, which has been named *coronium*, and it also appears to contain minute solid particles or dust, which reflect the sunlight.

The sun's mass is 750 times that of all the planets combined. Its attraction upon the earth in tons is represented by the figures 36 followed by 17 ciphers. If this attraction were transmitted through a material bond, it would require a bunch of steel wires, each as large as the heaviest telegraph wires used, and covering the sunward hemisphere of the earth, nine to the square inch. The effective temperature of the sun's surface is estimated at 6000° C., or about 10,000° F. The sun gives us 7000 million times the light of the brightest star, and in a year sufficient heat to melt a layer of ice 30 yards thick spread over the surface of the earth. But we get less than one 2000-millionth of the total heat radiated. If the sun were covered with ice 50 feet deep, the heat emitted would melt this in one minute. A minute proportion of the sun's energy may be supplied by meteoric impact, and a much larger proportion by its secular contraction and by radio-active transmutations. But probably a large part comes from sources as yet only dimly surmised, and it is now being suggested that the radiation of the sun and other stars is largely derived from an actual conversion of an extremely small fraction of their total mass into energy, the matter as such becoming annihilated in the process.—BIBLIOGRAPHY: C. G. Abbot, *The Sun*; H. Deslandres, *Annales de l'Observatoire d'Astronomie Physique de Paris*; G. E. Hale, *Stellar Evolution*; C. A. Young, *The Sun*; R. A. Sampson, *The Sun*; Sir R. Ball, *Story of the Sun*.

SUN AND PLANET MOTION. In mechanics, a train of two epicycloidal wheels, used by James Watt on the steam-engine. The sun wheel (on a central axis) is usually rotated by the other, or planet wheel, which is attached to the connecting-rod. *See* EPICYCLOIDAL WHEEL; STEAM-ENGINES.

SU'NART, LOCH. A sea-loch of Scotland, in Argyllshire, opening into the Sound of Mull. It is about 20 miles long, and varies in breadth from less than ¼ mile to 3 miles.

SUN-BATHING. Exposure of the body to the rays of the sun for reasons of health. The ultra-violet rays of the sun activate the ergosterol (q.v.) in the skin, which becomes vitamin D, required for bone formation. In addition they increase the power of the blood to destroy microbes, and tone up the system generally. Sun-bathing, which is of immense benefit in the treatment of rickets (q.v.) and lupus (q.v.), has become fashionable. Care should

be taken, however, not to allow the skin to become too rapidly sunburnt, and exposure for short periods is desirable at first.

The realisation of the beneficent action of sunlight has stimulated the growth of the Nudist movement—a movement aiming at physical health through the action of sunlight and air on the body, and at psychological well-being through the return to nature and the liberation of the mind from sex-repression and morbid curiosity. Nudist colonies have sprung up widely in Germany, also in Britain and the U.S.A. *See also* ULTRA-VIOLET RAYS.

SUN-BEAR. A name applied to some of the Indian species of the genus Ursus. The Tibetan sun-bear (*U. tibetanus*) is a black species with a white patch on the breast. The Bornean sun-bear (*U. eurysypilus*) has an orange-coloured patch. The Malayan sun-bear or bruang is a very small species. (*See* BEAR.) All the sun-bears are slenderly made, and their fur is not so heavy and thick as that of the other bears.

SUN-BIRD. The name given to a family (Nectariniidæ) of perching birds which are confined to the tropical regions of Africa and Asia, and in brilliant plumage and habits resemble the humming-birds. They

Sun-bird (*Nectarinia metallica*)

live on insects and the juices of flowers; their nature is lively and their song agreeable. They build in the hollows of trees or in thick bushes. Some species (such as *Nectarinia lotenia* and *N. asiatica*) make dome-like nests, which they suspend at the extremities of twigs or branches.

SUN-BITTERN. A South American bird (*Eurypyga helias*), rather smaller than a curlew, but with much shorter legs and a slender, straight bill. It frequents the banks of rivers, feeding on insects and small fishes. When excited, it drops its normal deliberate gait and goes through an extraordinary performance, dancing about with its broad and beautifully marked wings and tail fully spread. The bird has been somewhat of a puzzle to naturalists, but, like the *kagu* of New Caledonia, it is now generally regarded as a relic of an ancient type akin to the rails.

SUNBURY. A borough of Pennsylvania, United States, the county seat of Northumberland county, on Susquehanna River; served by the Pennsylvania and the Philadelphia & Reading Railways. The silk manufacture is most important, but there are also railway repair-shops. Founded in 1772, Sunbury became a borough in 1797. Pop. 15,626.

SUNBURY ON THAMES. An urban district of Middlesex, England, on the Thames. It is a boating centre, and contains Kempton Park and racecourse. Pop. (1931), 13,300.

SUNDA, STRAIT OF. A strait between the Islands of Sumatra and Java, and connecting the China Sea and the Indian Ocean. It is about 100 miles long.

SUNDA ISLANDS. Dutch East Indian island-chain extending west to east for 700 miles, between Java and Timor. The Greater Sunda Islands are Java, Sumatra, Borneo, and Celebes; the Lesser, Bali, Lombok, Sumbawa (largest), Flores (second in size), Solor, Adunara, Lomblen, Pantar, Alor, Sumba (Sandalwood), Savu, Rotti, and the smaller dependent islands. Netherlands geographers, however, do not recognise this division, classifying all the Dutch East Indies as either "Java and Madura" or "Outposts."

Physical Features. The main chain comprises a line of volcanic mountains trending east to west, and culminating in Rinjani (Lombok Island). All the islands are mountainous and have small coastal alluvial plains. Forming a southern line of outposts of the main chain are Sumba, Savu, and Rotti. Rivers generally are torrential from December until March, when they begin to dry up. The mean temperature is 78° to 80° F.

People. The chief peoples are the Hindu Balinese of Bali and Western Lombok, and the Sassaks of Eastern Lombok (Mahommedan) and Western Sumbawa (where the

population includes Arabs, Chinese, etc.). Otherwise the people are mainly pagan. Malay is the lingua franca.

Malaria, cholera, beri-beri, and dysentery are common. Bali and Lombok are of greatest economic importance. Articles on various islands should be consulted.

Smaller Islands. Savu joins with Rotti to form a division of Timor Residency. Food is not plentiful, and emigration to Rotti is considerable. Seba is the capital. Area, 231 sq. miles; pop. 14,000. The Solor, Adunara, Lomblen, Pantar, and Alor Islands are culturally backward. Their peoples are seafarers engaged in pearling, and use shell as a monetary standard. Adunara is the richest agriculturally.

SUNDARBANS, or **SUNDERBUNDS.** A vast tract of forest and swamp forming the southernmost portion of the Gangetic Delta, at the head of the Bay of Bengal; extreme length along the coast, about 170 miles; greatest breadth, 81 miles; and area, 7532 sq. miles. The northern parts only are inhabited, the southern parts being jungle and thick underwood traversed by gloomy-looking watercourses. The Sundarbans abound in wild animals, including tigers, leopards, rhinoceros (nearly extinct), buffaloes, deer, monkeys; the python and the cobra abound; crocodiles infest the river channels. Port Canning is the only town of importance.

SUNDAY (that is, day of the sun, like Monday, day of the moon). The first day of the week, the Lord's day. *See* SABBATH.

SUNDAY CLOSING. In Great Britain it is the law that shops and places of amusement must be closed on Sunday, but there are many exceptions. Public houses can legally be open at certain hours in England, but not in Wales. In Scotland each locality decides the question for itself. As regards shops where refreshments and newspapers are sold, the law is tacitly broken, and in Jewish quarters Sunday is regarded as the weekly shopping day. As regards places of amusement, the law is that no fees can be charged for admission to an entertainment on a Sunday. Theatrical performances, to which admission is by ticket only, are often given on Sunday.

In the case of cinema houses the local authorities allow them to open on Sunday provided the proceeds are given to charity, although strictly speaking this practice is illegal under an Act of 1780. Consequently they are open in some districts, for instance the county of London, but closed in others. In 1932 a measure was introduced to bring uniformity into the law. It was proposed to continue the law as regards theatres, but to alter it as regards cinemas. In its final form the measure allowed the cinema houses to remain open in those districts in which Sunday opening was already the rule. In other districts the local authorities could apply to Parliament for permission to open if the inhabitants clearly desired it. The opening hours, however, must not exceed five in the day, and the proceeds, as before, must be given to charity, except a part set aside for the support of a film institute.

SUNDAY SCHOOLS. The Sunday school in its simplest form is a meeting for children at which religious instruction is given in classes, generally by laymen and women, for the purpose of training the children in Christian principle and belief. To-day non-Christian bodies, such as the Buddhists in Japan and the Socialists and Communists in Great Britain, are copying Sunday-school methods for their own ends; but the idea is essentially a Christian one.

The immediate forerunners of Sunday schools were the little day or evening classes where good men and women taught reading, spelling, and morals with the Bible for their only textbook. Organised Sunday schools were first heard of in Scotland in 1709, and a little later in England; but the recognised founder is Robert Raikes (1735-1811), a Gloucester journalist, who, filled with sympathy for the poor children running wild in the streets of his native town, gathered them into the first Sunday schools. Through his writings Raikes was able to make known to the English public the need for Sunday schools, and the movement spread rapidly. At first ecclesiastical leaders were inclined to look askance on the work of laymen (even the law feared seditious or political teaching), but the Churches soon found in this method a very necessary supplement to the instruction given from the pulpit and around the family hearth.

To-day most denominations provide lesson schemes and teacher training courses for the schools connected with their churches; but the early period, when the work was managed almost entirely by the voluntary efforts of laymen, has left a great heritage in the unions of Sunday school workers, both local and national, founded for mutual

help and guidance, and still most valuable for their progressive and interdenominational spirit. The two great unions in Britain are the National Sunday School Union and the Scottish National Sabbath School Union, and similar organisations exist in Canada, the United States, South Africa, many European countries, India, Japan, etc. All these unions are linked together by the World's Sunday School Association, which has its headquarters in the Metropolitan Tower, New York City, and secretaries in many of the home and foreign fields. Conventions are held quadrennially in different parts of the globe, attended by delegates from all nations. At the Convention held at Los Angeles in 1928, it was estimated that the total membership of Sunday schools the world over was 33 millions of children and teachers, with a steady annual increase of 1 million.

To-day the Sunday school is much more elaborate and methodical than of old, though it continues to be staffed by voluntary labour. The aim is to lead all children into the Christian fellowship of the Church by training them in Bible knowledge, in worship, and in service. The first step is to connect the little babies with the Sunday school by means of the "cradle roll;" this is in the care of a motherly secretary, and is closely linked with the primary department, which has a beginners' class for four-year-olds. In the primary department thoughts of the loving Fatherhood of God and the friendship of Jesus Christ for little children are taught by means of Bible story, Nature talk, and simple hymn and prayer.

About the age of eight, boys and girls pass into the junior department, where the theme is the Hero Christ with His forerunners, the heroes of the Old Testament, and His followers, the hero disciples and missionaries; memory work and training in the worship of the Church are features of this department. The intermediate department—senior classes for boys and girls of twelve to fourteen—does work of a more intimate and personal nature, showing the meaning of Christianity to the individual and to the world to-day, and preparing for the young people's department or Bible classes with their more advanced study of Christian history and citizenship. The principal textbook in all departments is the Bible.

For all this work trained teachers are needed, not necessarily trained for day schools, but specially prepared for this work. Many Churches and unions have normal courses for the training of teachers; often the Sunday school has a special class for training its own teachers; but in Britain the plan that meets with general acceptance is to staff the primary department with lads and girls in their "teens," who attend a compulsory weekly training class, and get their practical experience with little groups of three or four children on Sunday, to whom they teach a lesson previously gone over by a skilled leader. After some three years they pass on to the junior department, where they attend a weekly discussion circle; in this way the individual Sunday school maintains its own supply of young trained teachers. Summer schools and local training courses provide further instruction, while leaders can be fully trained at special colleges. In Great Britain there are three such: the National Sunday School Union's College, Westhill, Birmingham; St. Christopher's, Blackheath, belonging to the Church of England; and the Women's Missionary College of the United Free Church of Scotland, Edinburgh.

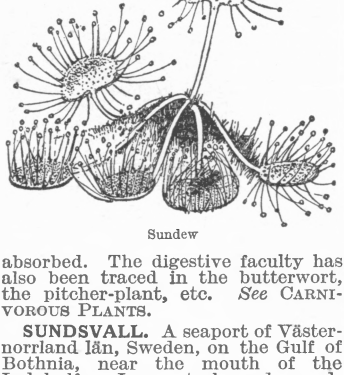
From its humble beginning as a philanthropic institution for the poorest and neediest children, the Sunday school has come to be the nursery of the Church, and, as its nursery, of central importance in this children's era. The term Sunday school must not, however, be limited to children's work, for, in some cases, it includes classes for adults of all ages who gather together for Bible study.

SUNDERLAND. A municipal and county borough and seaport of Durham, England, at the mouth of the Wear; served by the London & North-Eastern railway group. It includes nearly the whole of three parishes — Sunderland, Bishopwearmouth, and Monkwearmouth. There is a seaside suburb (Roker). The harbour and docks covers 200 acres, and its entrance is formed by two stone piers with lighthouses; two outer piers enclose a harbour of refuge. Shipping, the coal trade, and shipbuilding, the making of marine engines, iron-work, bottles, glass, earthenware, rope, etc., are the chief industries. Coal is the chief export; the imports are chiefly timber and grain, with various raw materials and provisions, from the Baltic ports, Holland, etc. Pop. (1931), 185,870.

SUNDEW (Drosĕra; nat. ord. Droseraceæ). Plants growing in bogs and marshes, having leaves clothed with reddish hairs bearing glands which exude drops of clear glutinous

fluid, glittering like dew-drops, whence the name. The three British species are *D. rotundifolia, intermedia,* and *anglica,* differing chiefly in the shape of the leaves. A characteristic of these plants is their habit of capturing insects by their viscid secretion.

Darwin, in his *Insectivorous Plants* (1875), says that the sun-dew derives its nitrogenous food by absorption from the tissues of insects entangled in the inflected tentacles of its viscid leaves; while, like other plants, it obtains and assimilates carbonic acid from the air. He further shows that these leaves have the power of digestion, and that they act on albuminous compounds in the same manner as does the gastric juice of higher animals, the digested matter being afterwards



Sundew

absorbed. The digestive faculty has also been traced in the butterwort, the pitcher-plant, etc. *See* CARNIVOROUS PLANTS.

SUNDSVALL. A seaport of Västernorrland län, Sweden, on the Gulf of Bothnia, near the mouth of the Indalself. Iron, steel, and wood-pulp are made; timber is exported. Pop. (1932), 18,267.

SUN-FISH (Orthagoriscus). A remarkable genus of fishes belonging to the order Teleostei, sub-order Plectognathi. These fishes are short and almost circular in form, their jaws are undivided, and they have no swimming-bladder. The sun-fish appears like the head of a large fish separated from its body, and when swimming it turns upon itself like a wheel. It grows to a large size, often attaining a diameter of 4 feet, and sometimes even that of 12 feet. The skin is hard and leathery, but the flesh is soft, white, and palatable. The liver is large, and yields an oil highly valued amongst sailors as a cure for rheumatism. The sun-fish is found in all seas from the Antarctic to the Arctic Circle. The two most familiar species are *O. mola* and *O. oblongus.*

Sun-fish

SUN-FLOWER (Helianthus), nat. ord. Compositæ. A genus of plants, so called from the resemblance of the yellow flowers to the sun with his golden rays. The root is mostly perennial; the stem herbaceous, upright, and often tall; the leaves opposite or alternate, undivided, often rigid and scabrous; the flowers large and terminal, usually disposed in a corymb.

The species are numerous, and mostly inhabit North America. The gigantic sun-flower (*H. annuus*), common in gardens, is a native of Peru. The stem is from 6 to 15 feet in height; the flowers, sometimes 1 foot in diameter, are usually turned towards the south. The seeds form an excellent nourishment for poultry and for cage-birds; and an edible oil has also been expressed from them. For the *Helianthus tuberosus,* or Jerusalem artichoke, *see* ARTICHOKE.

SUNN, or **SUNN-HEMP.** A material similar to hemp, imported from the East Indies, and used chiefly in the manufacture of certain types of ropes and box-cords. It is obtained from the stem of the *Crotalaria juncea,* a shrubby leguminous plant 8 to 12 feet high, with a branching stem, lance-shaped silvery leaves, and long racemes of bright-yellow flowers. Called also *Bombay hemp, Madras hemp, false hemp, Jubbulpur hemp.*

SUNNITE, or **SUNNI.** The Orthodox division of Islam, as opposed to the Shi'ites, or Unorthodox division. The essential difference between

them is that the Sunnites accept the *Sunna* as well as the *Koran*, and the Shi'ites do not.

The name Sunnite is derived from the word *Sunna*, meaning law or practice, and was given to a posthumous collection of the sayings of Muhammad, and some account of his works, both largely traditional (*hadith*).[1] That this was needed there can be no doubt, for the *Koran* recognises absolutely no difference whatever between spiritual and temporal matters, and the rapid welding of all-conquering Islam into a gigantic empire appears to have been entirely unforeseen by the Prophet, who made no provision for suitable laws, etc. It was said that Muhammad had left such laws in the keeping of Ali, but the compilation was completed from the personal recollections of the Prophet's followers.

Orthodox Islam is divided into four sects, all of which date from the early days of the Abbasids: (1) *Shafi'ite* (founded by ash-Shafi'i, (2) *Hanifite* (founded by Abu Hanifa), (3) *Malekite* (founded by Malek ibn Anas), and (4) *Hanbalite* (founded by ibn Hanbal) still existing in small numbers. All Sunnites belong to one of other of these rites. The division is scattered throughout the domains of the former Turkish Empire, and the claim of the Turkish sultan to the Caliphate (i.e. spiritual hegemony in Islam as vicar of God) is more or less admitted by the Sunnites generally. The Moroccan dynasty, however, has never recognised the Turkish Caliphate. Afghanistan, Muslim India, Turkestan, North Africa (*see* SENUSSI), and the nomad Tatar tribes of Asia are Sunnites, although the latter are only nominally such.

The Great Schism in Mahommedanism was occasioned after the death of Muhammad (who did not appoint his own successor) by the rise of two opposing parties, one of which (the Sunnites) supported the authority of the early Caliphs, while the other (the Shi'ites), "the party of the Prophet's House," asserted that the supernatural powers of Muhammad passed, through his daughter Fatima, to Ali and his descendants. The differences between the sects have been manifested in disputes regarding the Caliphate; and the Ottomans regarded the office largely from a political standpoint, as opposed to the Shi'ite view of its non-political and almost purely spiritual significance. The *Shi'ite* division forms the State religion of Persia. It has given to the world the Mahommedan poets, while the *Sunnite* division has provided the great Islamic warriors.

[1] It has been argued that a great deal of what he did not say and did not do has also been included. The great part that custom plays in the daily life of the modern Arab must be realised before the importance of the *Sunna* can be fully grasped.

SUN-STROKE. Any sudden and severe injury to the health resulting from the exposure of the head to a hot sun. The most usual symptoms of sun-stroke are the following: pains in the head, accompanied by fever; lethargy, or suffering which prevents sleep; congestion of the brain or other nerve-centres, or an inflammation of the brain sometimes ensues, and often terminates fatally. Sometimes the effects of the stroke can be discerned only in impaired bodily health or mental vigour dating from some occasion on which the patient was exposed to a violent sun.

SUN-WORSHIP. The adoration of the sun as a divinity sending and distributing light and heat, on which life and the fertility of the earth depend. Sun-worship is found among primitive as well as among more civilised nations. "The sunrise," writes Professor Max Müller, "was to man at the dawn of time the first wonder, the first beginning of all reflection, all thought and philosophy."

The chief object of adoration of the Aryans was the sun, which was to them not merely a luminary but a Ruler and a Creator, a Preserver and a Saviour of the world. He drove away the darkness and fertilised the earth. The principle of light, the Surya of the Hindus, Ormuzd of the Persians, Osiris of the Egyptians, Heracles and Dionysus of the Greeks, and Balder of the Teutons, was opposed to the principle of darkness, and imagined as engaged in a perpetual struggle. Among the Persians, Peruvians, and Mexicans sun-worship was afterwards amalgamated with fire adoration. The Aryans migrating east and west took their sun-myths with them and spread the cult of the sun.—BIBLIOGRAPHY: Charles Morris, *Aryan Sun-myths*; J. R. Harris, *The Heavenly Twins*.

SUN YAT-SEN, Dr. Chinese revolutionary, born 1867, a Cantonese by birth, but born in Honolulu; a Christian by religion, from his Christian parentage and early education in a missionary school; and a medical graduate of the American College in Hong-Kong, where he studied between 1887 and 1892. He favoured politics, however, becoming leader of the Chinese revolutionary movement, and was for fourteen years a political exile.

The Revolution of 1911-2, which culminated in the fall of the ancient Manchu dynasty and the establishment of a Republic, owed its success largely to the influence of Sun Yat-sen, who, from patriotic motives, passed the Presidency in favour of Yuan Shih-kai, who ultimately became Dictator. On the death of Yuan, he organised the Southern (Canton) party, and the fratricidal strife, which for years cleft China in two, was the child of his unscrupulous and anarchical political machinations.

In April, 1921, the Canton Parliament elected him " President of the Chinese Republic ;" but the new State was soon in financial difficulties, and, during the Civil War of 1922, the troops of Sun Yat-sen were decisively defeated (17th June). On 9th Aug. his army was again defeated (by Chan Chiung-ming), and Sun Yat-sen fled to Shanghai. Subsequently General Wu Pei-fu, the victorious leader of the North who overthrew Marshal Chang Tso-lin of Manchuria, connived at the assistance rendered the latter from Canton, and a path was thus cleared for negotiations. During 1923 it was announced that the Southern Government recognised the Peiping Government and would unite with it. *See* PEIPING. Sun Yat-sen died in March, 1925.

SUPEREROGATION, WORKS OF. In the Roman Catholic Church, the name for a class of good works which are considered to be not absolutely required of each individual as conditions to salvation. Such good deeds, it is believed, God may accept in atonement for the defective service of another.

SUPERHEATER. Steam is said to be superheated when at any given boiler pressure it has a higher temperature than the water from which it was evaporated. The object in superheating is to eliminate condensation in the steam-pipes and engine cylinders. The design of a superheater depends on the type of the boiler with which it is used. Owing to superheated steam having a comparatively low heat conductivity, it is essential that the superheater elements be of ample length to allow sufficient heat to be taken in by the steam. In the case of smoke-tube superheaters this is of special importance, the necessarily small diameter of the elements leading in these to high steam velocity.

A superheater consists of three parts : (1) the distributor, (2) the elements, (3) the collector. The distributor receives the saturated steam from the boiler through the regulator valve, and distributes it to the various superheating pipes or elements. The distributor and collector, especially on locomotives, are generally combined in one casting, commonly called a " header." The superheater may either form an integral part of the boiler or be independently fixed. A flooding arrangement is sometimes fitted to prevent the elements being burnt out when raising steam from cold water. The superheater is filled with water to the boiler level, and, prior to opening the regulator valve, the water is drained away. In general, about 100° to 150° F. of superheat is provided for, although in many cases steam superheated by 250° to 260° F. is employed.

SUPERIOR. In Scots law, one who or whose predecessor has made an original grant of heritable property on condition that the grantee, termed the *vassal*, shall annually pay to him a certain sum (commonly called feu-duty) or perform certain services. The superior's relation to the property so granted is called *dominium directum*, while the vassal's right in the property is called *dominium utile*. *See* FEU.

SUPERIOR, LAKE. One of the Great Lakes, the largest expanse of fresh water in the world, and the most westerly and most elevated of the North American chain of lakes. It washes the shores of the state of Minnesota on the west, those of Wisconsin and the northern peninsula of Michigan on the south, and those of Ontario in all other directions. Its greatest length is 412 miles ; greatest breadth, 160 miles ; circuit, about 1750 miles ; area, 31,200 sq. miles (or the same as that of Ireland). It is 602 feet above sea-level, and varies in depth from 80 to 200 fathoms. The lake receives many small streams, and finds an outlet at the south-east (to Lake Huron) by St. Mary's River. Duluth, Superior, Marquette, Port Arthur, etc., are lake ports. Navigation proceeds all the year round, as only the shore area is ice-bound in winter.

SUPER TAX. A form of income tax levied on the higher incomes, namely, those above £2000. After 1928-9 this tax was known as *Surtax*, and the first instalment of it fell due on 1st Jan., 1930. Super tax was first imposed in 1909, but only on incomes exceeding £5000, the rate being 6*d*. per £ and being levied only on the excess over £3000. In April, 1914, it was extended to all incomes exceeding £3000, the first £2500 being exempt. The rate was then

for the first time varied and rose from 6¾*d.* to 1*s.* 9½*d.* by successive income stages, each stage up to £8000 of income bearing its own particular rate, and the maximum rate being imposed on all incomes above that figure. Further increases were made from time to time as the exigencies of the European War demanded. The existing scale dates from 1930. On the first £500 above £2000, 1*s.* in the £ is charged, and the scale rises until it is 7*s.* 6*d.* in the £ on all income over £50,000 a year.

In addition, an additional 10 per cent was levied in 1931, making the highest rate 8*s.* 3*d.* in the £.

In 1932 the surtax produced £76,700,000. The tax is charged on the income of the year preceding that of the assessment. Earned income is taken at the full figure, and there are no deductions for life assurance premiums or for personal, family, or marriage allowances as in the case of the ordinary income tax. The full share of profits of the person chargeable must be taken into account although only a portion may have been drawn.

The tax is not levied on companies, and a shareholder brings into account only what he receives therefrom by way of dividend. This has led to the formation of companies for the sole purpose of evading the tax, and accordingly by the Finance Act of 1922 companies registered since 1914 were specially dealt with, and the Act seeks in certain circumstances to bring undistributed profits under liability. Section 31 of the Finance Act, 1927, extends to companies registered before 1914. The object therein is to make "one-man companies" show cause why they have not distributed a larger dividend.

SUPPLE-JACK. A popular name given to various strong twining and climbing shrubs.

SUPPLICANTS, THE. A name assumed in 1637 by the petitioners against the introduction of Laud's Service Book and the Book of Canons into the Scottish Church. *See* COVENANTERS.

SUPPLY OF ELECTRICITY. Electricity is a purchasable service, but its generation and sale in any particular district, and also the installation within a consumer's premises, are regulated by Government Acts and orders. An order for permission to supply electricity in any area must be obtained before any general scheme may be started. With a view to obtaining economical production, the grant of such orders and permissions to extend present equipment are only given after careful inquiry by the Electricity Commissioners. The present tendency is towards generation in bulk in what may be termed a super power station, and whatever scheme is suggested must be considered in relationship to the possible linking up or disbandment of many small stations.

Charging for Electricity. The electricity supply people usually provide the service connections, and generally without any direct charge; but when the cost is high, the consumer may be offered connection on paying for the service connections or by guaranteeing a certain minimum annual payment. The systems of charging for electrical energy are regarded by some consumers as most unnecessarily involved. They can appreciate the significance of charging by the simple meter reading, as is done with gas. Such a system is frequently used, but is not perfectly satisfactory, in that with it no account of the time at which the demand comes on the system is made. Meter charging at so much a cubic foot or therm serves for gas, as all the supply is taken from storage; whereas with electricity the case is different, as, generally speaking, the electricity must be generated at the moment of demand. It is for that reason that the apparently involved systems have been introduced. If supply is only taken at times of low load, it may be supplied cheaply, but if taken at peak times, the cost is much greater, for every addition to the possible peak load means an increased size of power plant.

The various systems in use have as their aim the assignment of an equitable cost to each consumer, made up of interest on capital, cost of plant, and actual production charges. In some cases consumers have the option of paying a flat rate of a certain sum each year, or paying a percentage of the rateable value of the premises, together with a small charge per unit. Amongst other methods, one in fairly common use is to make a charge against the number of kilowatts of maximum demand. In artisans' dwellings a fixed charge for the current for each lamp installed is a method much in favour.

Wiring Rules. All electrical work in a house or workshop should be carried out to the specifications embodied in the rules of the fire insurance company, of the Institution of Electrical Engineers, and of the local supply authority.

SUPRA-RENAL CAPSULES. Two small yellowish glandular bodies which exist, one at the front portion of the upper end of each kidney (*see* KIDNEY). They have no excretory duct, and are connected with the kidneys by areolar tissue only. They consist of an outer or *cortical*, and an inner or *medullary* portion; the former being of a deep yellowish colour, and the latter of a dark-brown or black hue, and of a soft and pulpy formation. The capsules are furnished with numerous nerves, and derive their blood from the *aortic*, *renal*, and *phrenic* arteries, returning it by the *supra-renal* vein. They are present in all mammals. Their exact functions are as yet uncertain. In the embryo they are larger than the kidneys themselves, but in the adult possess only about $\frac{1}{30}$th of their original bulk. *See* ADDISON'S DISEASE; ADRENALIN.

SUPREMACY, ROYAL, as a term in English law, is practically restricted to denote the authority of the Crown in matters ecclesiastical. After abolition of the Papal supremacy at the English Reformation, the royal supremacy was affirmed by various Acts under Henry VIII. and Elizabeth, all enforcing an *oath of supremacy*. The oath was taken by holders of public offices along with the oath of allegiance, and afterwards with that of abjuration, until the three were consolidated in one by 21 and 22 Vict. c. 48. This was again subjected to revision in 1868.

SUPREME COUNCIL. Term used for the council set up by the Allies in Paris in 1919. Its business was to see that the terms of the peace of Versailles were carried out and on it were representatives of Great Britain, France, and Italy. It ceased to function in about a year. Earlier, in 1917-18, there was a **Supreme War Council.** This met at Versailles and its business was to direct the operations against the Germans, thus establishing a single control.

SUPREME COURT OF JUDICATURE. An English court constituted by the Supreme Court of Judicature Act, 1875, which provided for the union and consolidation together of the higher courts, such supreme court consisting of two permanent divisions called the *High Court of Justice* and the *Court of Appeal* (*see* LAW, COURTS OF).

The ordinary judges (or justices) of the High Court have equal power, authority, and jurisdiction, but they sit in three divisions: the Chancery division, consisting of five justices, with the Lord Chancellor of England as president; the King's Bench division, consisting of fourteen justices and the Lord Chief Justice as president; and the Probate, Divorce, and Admiralty division, consisting of two judges or justices. The criminal jurisdiction of the court is exercised entirely by the King's Bench division. The Lord Chancellor is not to be deemed a permanent judge of the court.

The Court of Appeal has appellate jurisdiction only, with such original jurisdiction as may be necessary to dispose of cases of appeal. It consists of four ex-officio judges and of five ordinary judges appointed by letters-patent. The ordinary members of the court are called Lords Justices of Appeal. The four ex-officio judges are the Lord Chancellor, who is the president, the Lord Chief Justice of England, the Master of the Rolls, and the President of the Probate, etc., division. The Court of Appeal is a superior Court of Record, and the highest court of appeal under the House of Lords. In hearing ecclesiastical appeals the court is composed of judges and assessors, the latter being archbishops or bishops of the Church of England. The supreme courts and any of the judges are at liberty to sit at any time or place. Commissioners of assize on circuit are continued. Matters not proper to be heard by a single judge are to be heard by divisional courts of the High Court consisting of three or not less than two judges. The determination of these divisional courts is to be final, unless the court gives special leave to appeal.

Until 1907 no appeal lay from a criminal verdict, but only on the ground of misdirection of the jury on a point of law, on which ground the High Court might quash the conviction. (In that year, however, a new Court of Criminal Appeal was set up, and appeals on wider grounds can be taken to it from the judgment of the court at quarter sessions, assizes, the central criminal court, or the King's Bench division of the High Court.)

SURABAYA. *See* SOURABAYA.

SURAJ'AH DOW'LAH (*Sirâj-ud-Daulah*). The last independent nawab of Bengal, under whom was perpetrated the massacre of the Black Hole (q.v.). He succeeded his grandfather, Ali Verdy Khan, in 1756, and within two months of his accession found a pretext for marching on Calcutta. On the arrival of Clive and Admiral Watson he retreated to Murshidabad, but was routed at the battle of Plassy (23rd June, 1757). He then fled up the

Ganges, but was betrayed, and executed by order of the son of Mir Jaffier, the new nawab. Surajah Dowlah's reign lasted fifteen months, his age at the time of his death being barely twenty.

SURAT'. A district and city of Bombay province. The district is a broad alluvial plain with a coast-line along the Arabian Sea; served by the Bombay, Baroda & Central India, and the Tapti Valley Railways. Rice, cotton, wheat, castor-oil, and native cereals are raised. Surat City is the district headquarters, and was formerly the commercial capital of India. Area (district), 1651 sq. miles; pop. 674,351; (city), 117,434.

SURBITON. Urban district of Surrey. It is 11 miles from London, on the Thames and is reached by the S. Rly. A residential district for Londoners, it is visited for the boating. Pop. (1931), 29,396.

SURETY. A surety is one who has become bound for the due payment of a debt or performance of an obligation by another person. A contract of suretyship must be in writing, the Statute of Frauds enacting that no action shall be brought on the promise of anyone "to answer for the debt, default, or miscarriage of another person" unless such promise is evidenced by writing. But only a collateral agreement or guarantee need be so evidenced. If the promise is of the nature of an indemnity, it is binding though not reduced to writing. Thus A and B go to a tailor; A orders a suit of clothes; B says to the tailor, "If A does not pay you, I shall do so"; that is a guarantee and requires writing. But if B says, "Charge the cost to me," he makes himself the debtor, primarily responsible for payment, and writing is unnecessary.

Unless otherwise provided by the contract, the creditor may proceed against the surety for payment without first suing the debtor. A surety who pays comes in place of the creditor, and is entitled to the benefit of the securities held by him. If the creditor has accepted a modified sum from the surety, the latter cannot recover more from the debtor. If there are several co-sureties, anyone who pays the debt has relief against the others for their shares.

SURF-DUCK, or **SURF-SCOTER.** A species of duck (*Oedemia perspicillata*), about the size of a mallard, rarely seen on the British coasts, but frequent on the coasts of Labrador, Hudson Bay, and other parts of North America. *See* SCOTER.

SURGEONS, ROYAL COLLEGE OF. An English medical body established in London, descended from the Company of Barber-surgeons, incorporated by royal charter in 1461. A separate association of surgeons was formed some years later, but in 1540 the two companies were united by Act 32 Henry VIII. cap. xlii. into one corporation under the title of Masters or Governors of the Mystery and Commonalty of Barbers and Surgeons in London. In 1745 the latter were raised into a separate corporation. By a new charter granted in 1800 the title of the company became the Royal College of Surgeons in London; and by another charter granted in 1843 the name of the corporation was changed to that of the Royal College of Surgeons of England; and the college was authorised to create a portion of its members fellows.

The government of the college is vested in a council of twenty-four members, including president and vice-presidents, the whole to be fellows of fourteen years' standing. A court of examiners of the members (fellows), with a president and two vice-presidents, is elected by the council. The college also appoints special examiners in midwifery, dental surgery, and in various departments of scholarship, preliminary to fellowship examination. The examination for membership of the college includes a preliminary examination in general scholarship, an anatomical examination, and the surgical or pass examination. By the Medical Act, 1858, the college is one of the bodies authorised to license practitioners of medicine within the United Kingdoms (*see* MEDICAL ACT).

The buildings of the college are on the south side of Lincoln's Inn Fields. They contain a museum, library, and theatre for lectures. The museum is one of the most valuable scientific collections in the world. The new examination hall, held conjointly with the Royal College of Physicians, is at 8-11 Queen Square, Bloomsbury.

SURGERY. While certain procedures which would now be called surgical operations are at least sixty centuries old, and the regular practice of surgery goes back at least as far as the time of Hippocrates, the last century has witnessed such a tremendous extension of the range and the accuracy of the surgical operations, that it is perhaps not an exaggeration to say that Sir James Young Simpson and Lord Lister have created a new art by

introducing the use of chloroform and antiseptic procedures respectively.

The earliest-known inhabitants of Egypt already practised a form of circumcision, which was performed for ritual rather than for surgical purposes, and the custom of amputating a finger for similar reasons is as old if not even older. The use of splints for treating fractures of the arm and leg goes back at least as far as the Pyramid Age in Egypt (*British Medical Journal*, 28th March, 1908). The practice of trephining (popularly known as trepanning) the skull is probably almost as ancient, and has existed among primitive people in various parts of the world for many centuries.

But real surgical operations, i.e. using the knife definitely for the cure of disease, were unknown before the sixth century B.C. Although practised by the Greeks in Ionia and Cos, surgery was probably first established on an extensive scale by the Greek practitioners in Alexandria about 300 B.C., and by them the art was handed on to Syria and Europe. The renaissance of learning in Europe in the sixteenth century, and especially the increased attention then given to anatomy, acted as a great stimulus to surgery, for it provided the operator with a much more intimate knowledge of the geography of his field of operations, and hence gave him confidence to undertake procedures which before then he would not have dared to attempt.

Anæsthetics. However, until the introduction of the use of anæsthetics in the nineteenth century, surgical operations were attended with such risks and caused such terrible agony to the subjects of these operations that they were rarely submitted to except when the alternative was death. Moreover, one of the chief aims of the surgeon was to complete the operation as rapidly as possible, so that the careful technique of the modern surgeon was almost impossible of attainment. The introduction of the use of anæsthetics changed all this. It not only spared the patient the awful agony and the shock that went with it, but it made operations safer, and it permitted the surgeon to practise his art in a more careful and thorough manner. Nevertheless, there was always the risk of septic infection, which added immensely to the danger of any surgical operation.

Lord Lister's application to surgery of the knowledge of germs, acquired largely as the result of Pasteur's researches, has brought about a complete revolution in the art. It made it possible for the surgeon freely to invade regions like the abdomen and the cranial cavity; this before his time would have involved the gravest risks. It has made it possible also for him to perform numerous plastic operations which it would have been useless for him to attempt in the days when he knew that suppuration was inevitable. But, more important than even these two results, it has given surgery a safety and a precision which was lacking before Lister's time, so that vast numbers of operations are now performed on almost any part of the body without submitting the patient to any exceptional risk or grave discomfort, such as he would have had to suffer a century ago.

At the present time several anæsthetic procedures, both of a general and a local action, are used in surgery, and the danger of accidents due to the anæsthetic has been considerably reduced. Instead of attempting to destroy the infective agents in the wounds made by the surgeon, and so run the risk of injuring the patient's tissues, the modern surgeon aims at asepsis, i.e. he tries to prevent germs from gaining access to the wound. For this purpose the surgeon and his assistants adopt elaborate measures to sterilise the instruments and their own hands, and by means of careful attention to the preparation of the operating-room and the patient, and by the use of special clothing and masks, they prevent the access to the seat of operation of anything at all likely to convey infection.

Surgical Operations. Surgical operations are undertaken for a variety of objects, such as the removal of foreign bodies (bullets, etc.) from the body, or concretions or calculi from the bladder, kidney, gall-bladder, or other hollow organ; the removal of cancerous or other forms of growth which involve risk to life or grave discomfort to the patient, or of dead or diseased tissues, such as carious bone or teeth, gangrenous intestine, inflamed appendix, etc., which may be either dangerous or disagreeable; the relief of obstructions in any of the hollow tubes of the body, such as the intestines or the air-passages; the relief of conditions such as hernia, which may involve the risk of such obstructions or even danger to life; or the opening and draining of abscesses and the evacuation of unnatural accumulations of fluid in the pleural or other cavities of the body.

In addition to these varieties of

surgical procedures, surgical operations are frequently performed to correct congenital defects, like club-foot, knock-knee, hare-lip, and a whole series of deformities that come within the province of the orthopædic surgeon. Similarly, many operations are now performed to remedy defects caused by injuries, such, for instance, as transplanting skin, or plastic procedures to make a new nose when that organ has been lost, or to effect some other repair to a face whose æsthetic qualities have been marred.

The greatest triumphs attained by surgery within recent years have been the direct result of the confidence and freedom from grave risk which the use of anæsthetics and aseptic methods has made possible. The surgeon can now confidently open up the body cavity or the brain case, and deal directly with deep-lying tumours or diseased conditions. He can remove calculi from the gall-bladder or kidney, cut away cancerous growths from the stomach or intestines, and remove large parts of the alimentary canal, or even the whole uterus and its appendages. He can excise tumours of the brain and relieve abscesses within the skull. He can open the spinal canal and relieve pressure upon the spinal cord or the nerves. He can correct the effects of displacement of organs by strengthening the normal supports of such organs as the uterus or kidneys. But all of his procedures do not involve the use of the knife. He sets broken bones and performs many operations on joints without cutting. The surgeon is, in fact, able to remove or readjust almost any part of the body, and to correct displacements due to fracture, dislocation, or congenital defect.

Specialisations of Surgery. But there are many specialisations of surgery, each with its own set of highly skilled procedures. For example, the ophthalmic surgeon performs a variety of extremely delicate operations within the eye or upon the eye-muscles or tear-ducts. He may remove the lens when it is rendered opaque by cateract; he may alter the attachments of muscles to cure squint, or he may have to remove obstructions from the tear-ducts.

The otologist similarly performs operations on the ear and its appendages: he may open an abscess inside the ear or in the mastoid, or may have to clear away an obstruction in the passage (Eustachian tube) that conveys air from the throat (pharynx) to the middle ear.

The laryngologist has for his province not only the larynx or voice-box, but also the pharynx and air-passages.

The gynæcologist is a surgeon whose speciality it is to deal with the organs of reproduction in women. In addition to operations for removing tumours or other diseased conditions of the uterus and its appendages, there are many surgical procedures for correcting displacements of the uterus, and especially for remedying prolapse of the uterus, bladder, or rectum.

The obstetric surgeon performs operations of different kinds on women when there is difficulty in parturition. Such procedures may consist simply of altering the position of the child in the womb so as to facilitate its birth, or by means of forceps actively to help it to effect its birth. But in some cases the surgeon may have to open the abdomen and the uterus within it and bring the child out by this means. This Cæsarean Section, as it is called, is only resorted to when the pelvic cavity is so narrow that birth by the normal passage is quite impossible.

One of the most important branches of surgery is *orthopædics*, to which reference has already been made as the department of the art concerned with the correction of malformations, whether the result of injury or of congenital defect. As an outcome of the European War, the scope of orthopædic surgery has been widely extended. Not merely the results of direct injuries to limbs and the deformities so produced still call for the skilled treatment of the orthopædic surgeon, but also an even larger number of patients who have suffered damage to their nerves, with resulting paralysis of muscles and deformities of limbs. But the chief scope for the orthopædic surgeon's activities lies in the correction of congenital deformities, such as club-foot, and the prevention of the development of such conditions as hunchback.

Dental surgery is a highly specialised branch, the chief aim of which is essentially conservative, to remedy defects due to caries and other septic processes, and to prevent or correct irregularities of the positions of the teeth.

In fact the main purpose of surgery is essentially conservative, to remove conditions that might endanger life or cause serious suffering. It is impossible to estimate the extent of the boon conferred upon suffering mankind by surgery since its scope has been widened by the discoveries of Simpson and Lister.

At the present time every qualified medical practitioner is required to have gone through a training to equip him for the work either of a physician or a surgeon. But in former times the craft of surgery was, to a large extent, in the hands of barbers; and the Company of Barber-surgeons, which was incorporated in London in 1540, lasted until 1745 before it gave place to the College of Surgeons, which has been in evidence since 1460, but was not incorporated until 1800. The Edinburgh College of Surgeons, however, was incorporated in 1505, and the corresponding college in Ireland in 1786.

SU'RICATE (*Suricata tetradactyla*). An animal of the Cape Province allied to the ichneumon, sometimes domesticated as being an exterminator of rats, mice, and other vermin.

SURINAM. The Dutch colony of Guiana (q.v.). Also a river of that colony, 400 miles long, navigable for 40 miles by large, and over 100 miles by small, vessels.

SURPLICE. A white garment worn by priests, deacons, and choristers in the Church of England and the Roman Catholic Church over their other dress during the performance of religious services. It is a loose, flowing vestment of linen, reaching almost to the feet, having sleeves broad and full, and differs from the *alb* only in being fuller and having no girdle nor embroidery at the foot.

SURREY, Henry Howard, Earl of. English soldier and poet, born about 1516, died 1547. He succeeded to the courtesy title of Earl of Surrey when his father became third Duke of Norfolk (1524). The Howards (q.v.) held an eminent position at the court of Henry VIII., and Surrey's cousin, Catherine Howard, became the king's fifth wife. Shortly before Henry's death Surrey and his father were suspected of aiming at the throne, and were arrested and lodged in the Tower, and Surrey was tried, condemned, and executed on Tower Hill. Surrey was one of the leaders of the early poetic movement under Henry VIII. Most of his poems were translations or adaptations of Italian originals. His translations of the second and fourth books of the *Æneid* are the first attempt at blank verse in the English language.

SURREY. A county of England, bounded by the Thames, separating it from Buckinghamshire and Middlesex; by Kent, Sussex, Hampshire, and Berkshire; area, 461,833 acres. The North Downs stretch across the county from east to west, and on the south descend to the Weald, a flat plain extending into Kent and Sussex. Leith Hill (965 feet), near Dorking, is the culmination point of the North Downs. Almost the whole of the county is drained by the Thames, with its tributaries the Wey, Mole, and Wandle.

Agriculture is progressive, but there are large heathy areas; market-gardening and sheep-rearing (on the Downs) are important. Hops are grown in Farnham area. The vicinity of the metropolis, and the beautiful sites which the county affords, have caused many parts of Surrey to be settled as residential areas, e.g. Kingston-upon-Thames, Richmond, etc. The county in its ancient area contained Southwark, Lambeth, and other metropolitan districts or boroughs; Guildford (county town), Godalming, Reigate, and the boroughs of Croydon and Wimbledon (London) are important. Pop. (1931), 1,180,878.

Surplice

SUR'ROGATE. One who is substituted or appointed in the room of another, especially the deputy of a bishop or ecclesiastical judge. The chief duty of ecclesiastical surrogates is the granting of marriage licences.

SUR'TURBRAND. Fossil wood, impregnated more or less with bitumen, found in great abundance in

Iceland. It is used by the Icelanders chiefly in their smithies. It is sometimes so little mineralised as to be employed for timber.

SURVEYING. The art of determining the positions and heights of objects on the earth's surface, or merely relatively to each other. The field work of surveying consists of linear and angular measurements, which are carried out with a degree of precision depending upon the scope and importance of the survey.

Geodetic surveys (*see* GEODESY) are those conducted with the direct object of determining the form and dimensions of the earth (e.g. the historic arcs of Peru and Lapland, began by the French in 1735), and those whose extent and precision allow of their use for this object (e.g. the primary triangulation of Great Britain, and the great triangulation of India).

Geographical, topographical, and cadastral surveys are those which portray the area surveyed on paper. *Geographical* surveying aims at the production of generalised small-scale maps; *topographical* surveying, of maps of more precision at medium scales; and *cadastral* surveys are for the delineation of property boundaries and the assessment of areas, and are therefore carried out at large scales.

Engineering surveys with some specific end in view, such as the construction of a railway, dam, reservoir, etc., generally, but not invariably, aim at mapping an area at topographical or cadastral scales.

Mining surveys require special methods for measurement underground, and *military* surveys may include all the above.

The numerous errors, instrumental and personal, accidental and systematic, inherent to surveying processes, and the laws of the propagation of these errors, govern the choice of method and instrument for each particular case.

The Control. In all surveys, which have more than a purely local significance, the first step is to construct a framework of points whose positions are known with precision. Upon this framework rests the subsequent survey of detail.

It will be as well to illustrate the construction of such a framework by describing, as a concrete case, that of the Ordnance Survey of the British Isles. The standard of length of the Ordnance Survey is an iron bar, upon which a length of 10 feet is defined by fine lines graved upon small circular platinum studs. Two bases, Salisbury Plain and Loch Foyle (6·9 and 7·9 miles respectively), were measured with Colby's compensating bars, in terms of a foot of the standard. These bases are directly connected with each other through the triangulation, and the difference between the length of Loch Foyle base as measured, and as calculated from the Salisbury base, is 1/93,000 of its length. A mean value was established between the two by lengthening the one and shortening the other, to eliminate this discrepancy. From these two bases a triangulation, comprising 552 triangles, is extended to cover the whole of the British Isles, and four other bases serve to ensure that no noteworthy errors have crept in. The six bases, widely separated from each other, tend to show that the length of any side of the triangulation includes no error greater than one 60,000th part of itself. The triangulation takes the form of a close network of triangles, forming one strongly connected figure, The mean length of a side is 35·4 miles, and the probable error of an angle, as deduced from the triangular errors, is 1·23 seconds. As is usual in such triangulations, the whole network is adjusted in a mathematical analysis depending upon the theory of least squares, so that the length of any one side calculated from any other by all possible different paths through the triangulation remains the same. Astronomical observations for latitude, azimuth, and time were made at a large number of stations, and calculations for the relative positions on the spheroid are based on Airy's figure of the earth (a = 20,923,713 feet; compression, 1/299·3).

A modern primary triangulation generally forms an open grid of adjusted lines of triangulation rather than a continuous interconnected figure, and the probable error of an angle observed with modern instruments is about 0·4 second. Modern bases are generally measured with invar tapes or wires suspended in catenary, and tend to become more numerous and individually longer, although no more accurate than the older type.

Within the area covered by the primary triangulation, and depending upon, or adjusted to it, come a second, third, and possibly a fourth order of triangulation. These descending orders break up the large main triangles until fixed points, every mile or every 2 miles apart, afford a sufficient control for surveys of detail. The inferior orders of triangulations are occasionally re-

placed by traverses, but only in cases where the difficulty and cost of triangulation render it prohibitive. The subject of transverses generally will therefore be considered under "Detail Surveying."

Control points may be fixed by resection from a number of already known points. Resection depends upon the fact that any three points (A unknown, and B and C known) lie upon a circle whose radius can be calculated from the known length BC, and the observed angle O, subtended at A. When three known points, B, C, D, are observed upon, the point A, where the circles ABC and ACD cut each other, can be circulated by one or other of a variety of solutions, or determined graphically on the plane-table. Resection is particularly important in marine surveying, and a mechanical solution of the three-point problem with the "station plotter" is commonly used.

Field Astronomy. In order to place any survey in its correct position upon the earth's surface, it is necessary to know, or to fix by astronomical means, the latitude and longitude of one point and the azimuth of one point from another. In field astronomy we imagine the earth to be a point of negligible dimensions in the centre of a hollow sphere, upon the surface of which the sun and stars revolve around a prolongation of the earth's axis. The positions of the sun and stars on this sphere at any moment are known, and tabulated in the *Nautical Almanac*. Now, if we consider the position of any star relatively to that of an observer on the earth's surface, we see that its altitude (or height above the horizon) and azimuth (bearing from true south by west) will vary according to the latitude and longitude of the observer (*see* NAVIGATION). From suitable observations, and by consulting the *Nautical Almanac* for the date and time of observation, we may solve the *astronomical triangle* whose apices are the observer's zenith, the elevated pole (north or south), and the heavenly body, and may then calculate the latitude of observation, the local (solar or sidereal) time, or the azimuth of any point included in our observations.

Observations and calculations for latitude, azimuth, and time present few difficulties, but are burdened by the error in the observed altitude, due to "local attraction" (*see* GEODESY). In order to determine longitude, we must know both local and Greenwich times of observation, the difference between which is the required longitude. Local time is calculated from the astronomical triangle. Greenwich time is obtained generally (in modern practice) by an interchange of telegraphic signals at stated intervals, between the point of observation and some other point whose longitude (and therefore Greenwich time) is already known. It may also, and with great advantage, be procured by receiving by wireless telegraphy the time signals sent out from the Paris or Berlin wireless transmitting stations.

Detail Survey. Once the controlling framework of points has been completed by triangulation, the topography may be mapped in detail by a variety of methods of less precision and expense. These methods may be classed under the following headings: (1) Traversing, (2) Chaining, (3) Tacheometry, (4) Plane-tabling, (5) Photogrammetry (q.v.).

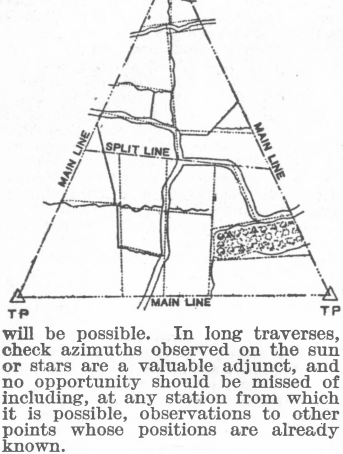
A golden rule of surveying is, that no step in the work should remain unchecked. None of the above methods of survey should be considered final, and the survey or plan should not be considered complete until the result has been subjected to a check on the ground.

(1) *Traversing.* A traverse consists of a number of measured lengths and bearings forming a connected series. The linear measurement may be carried out with tapes or bands of invar or steel, or optically by tacheometry. The angles may be observed with theodolite, sextant, or compass. Traverses which replace the lower orders of triangulation generally start from one point of the triangulation, and close upon another. Their lengths are measured with standardised metallic tapes, and their bearings with good transit theodolites. Traverses run for the survey of detail are carried out with less precision, and form a record from which may be plotted the positions of the details of topography along the line of the traverse and within a short distance on either side of it.

The errors of linear measurement in traversing may be taken to accumulate in proportion to the square root of the distance traversed. Angular errors, due to imperfect centring of theodolite and signals, etc., may also be said to accumulate in proportion to the square root of the number of stations. There is, however, no possibility of definitely assessing the error in position of any point of the traverse other than the starting and closing points.

It is usual in adjusting a traverse

to its controlling points to make use of the following rule: "As the arithmetical sum of all the latitudes (or departures) is to any one latitude (or departure), so is the whole error in latitude (or departure) to the correction to the corresponding latitude (or departure)." Traverses are often so run as to form a closed figure or polygon. In such cases the sum of all the interior angles should be equal to $(2n \times 90 - 360)$ degrees, where n is the number of sides to the figure. Particular care should be taken in the standardisation of the band or chain used for linear measurement, in order to prevent errors of scale upon which no check



will be possible. In long traverses, check azimuths observed on the sun or stars are a valuable adjunct, and no opportunity should be missed of including, at any station from which it is possible, observations to other points whose positions are already known.

(2) *Chain Surveying.* Chaining, the oldest method of detail survey in common use, is still the most effective for cadastral or large-scale work. In essence it consists merely of measuring straight lines on the ground between points which are already fixed, noting where these lines cut the detail to be mapped, and "offsetting" to other suitable points. It becomes then, in theory, a form of traversing; but as the figure chained is rigid (if all lengths be known), angular measurement is not required. The control (from triangulation or traverse) having been established, three fixed points are selected, and the sides of the triangle formed by them are first "traced" on the ground and marked with flags or staffs and then chain measured. These sides are called *main lines.* *Split lines* are lines which cut up the triangle into suitable blocks for the detail surveyor. The points between which these split lines run are chosen and marked during the tracing of the main lines. *Detail lines* are those which are run between points, chosen on main and split lines, in such a way as to complete the survey begun by the first two processes. Finally, the *offsets* consist of short distances measured at right angles to, and at either side of, each type of line, to provide that every point of the area to be surveyed is actually plottable from the field book.

The stores required consist of a small theodolite for tracing lines, a chain or steel tape for measuring distances, and *arrows* which mark the terminals of each chain or tape length.

The errors which are allowed in the chaining and the length permitted for offsets are the subject of special rules governed by the importance of the survey. Generally, for surveys at a scale of about 1/2000, we may say that (*a*) the distance between control points should not be greater than 1½ miles; (*b*) the difference between the calculated and measured length of any line should not exceed 1/1000 of that length; (*c*) offsets should not be more than 30 feet.

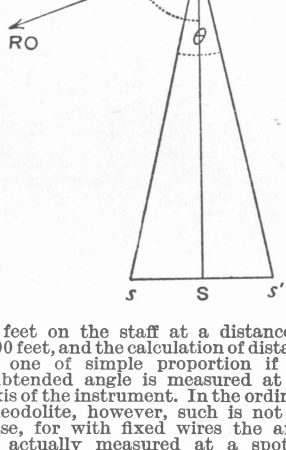
(3) *Tacheometry.* Tacheometry (or *rapid measurement*) aims at measuring the bearing and distance to one or more stations and fixing their polar co-ordinates with reference to the position (supposed known) of the tacheometer or theodolite. The theory is exceedingly simple.

Let T be the position of the tacheometer, and S the station to be fixed. Let RO be some reference mark whose bearing from T is ϕ, let ss' be a short base of known length 1, and θ be the angle subtended at T by 1. Let α be the horizontal angle at G between S and RO. Then the bearing of S from T is $\phi \pm \alpha$; and the distance of S from T is $\frac{1}{2} \cot \frac{\theta}{2}$.

In practice this general idea is developed in two ways according as θ is a fixed angle, defined by hairs or lines in the diaphragm, and 1 is variable, or 1 is a fixed distance and θ is measured (generally by repetition) on the horizontal or vertical arcs. In both cases 1 is small compared to TS, and the accuracy of these methods is therefore poor. The term tacheometry is usually confined to the first of these two ways, where θ is fixed and 1 variable,

and the second is usually known as subtense.

A tacheometric survey is carried out by parties averaging six to eight men. An observer reads the instrument and calls out his results to a computer, who books and calculates horizontal and vertical distances. Bearings are generally plotted direct upon a plane-table on which the tacheometer stands (although they may be read, booked, and plotted subsequently); four to six *rodmen* move as directed, and hold their graduated staffs vertically on the spot indicated. The lines or hairs in the diaphragm are usually so disposed as to intercept 1, 2, or



3 feet on the staff at a distance of 100 feet, and the calculation of distance is one of simple proportion if the subtended angle is measured at the axis of the instrument. In the ordinary theodolite, however, such is not the case, for with fixed wires the angle is actually measured at a spot in front of the axis, and a constant must therefore be employed in calculation. In modern tacheometers, however, an *anallatic* lens (which reduces angles to the axis) is inserted between the object glass and diaphragm.

If the rod or staff be on a different level to the observer, the computations for the horizontal and vertical distances require the use of sines and cosines. To replace this calculation on paper two instruments have been devised. The *Beaman arc* can be fitted to any tacheometer, and reads direct in sines and cosines, and the *Cooke's direct-reading tacheometer* gives all the necessary data for a much simplified calculation from the readings of the positions of three needles in the field of view. Sights are usually confined to distances of from 200 to 250 yards.

As a method tacheometry is useful for mapping at medium scales (1 : 20,000 to 1 : 5000), and for engineering surveys, such as railway location, catchment basins, etc. It is unsuitable for employment at small scales, and at large scales finds a serious rival in chaining. Subtense methods, of less general application, are more useful for mapping at small scales, and for occasional use in areas of particular difficulty. The fixed base may be improvised in many different ways, and may, for example, take the form of the measured distance between two poles (as has occurred in tropical surveys) or the measured length of the cleaning-rod of a gun (in military surveys). The subtended angle measured on the horizontal arc is generally repeated, say, ten times, the extreme readings only being booked, and the result divided by the number of repetitions. Sights may be taken up to the limits of visibility if the base be sufficiently long, but in practice are seldom more than 1 mile.

(4) *Plane-tabling.* A plane-table consists of a flat table which stands upon a tripod, and designs of plane-tables vary from highly finished, elaborate instruments, embodying slow motions for all movements, to simple strong tables, levelled by moving the legs and oriented by hand. Plane-tabling consists in determining graphically the positions of a number of points additional to the controlling triangulation, by the intersection of rays or by resection, and of filling in intermediate detail by eye. In the hands of a well-trained topographer the plane-table is an accurate and reliable instrument, and large areas in India and Africa have been mapped in this way. It can be used with advantage for medium and small scales (1 : 20,000 to 1 : 250,000), but is not suitable for large scales except as an adjunct to the tacheometer. It is a useful auxiliary to phototopography, for by its means a number of natural objects, such as appear clearly on a photograph, can be fixed quickly and accurately.

The Vertical Control. No survey would be complete which did not include the determination of relative heights. For this reason a vertical control is necessary to govern the contouring, just as a horizontal control governs the detail survey. The vertical control is supplied in most important surveys by spirit levelling (*see* LEVELLING). In topo-

graphical surveys it is generally provided by calculation depending on known distances and angles of elevation and depression, observed with the theodolite or tacheometer and clinometers. Altitudes fixed in this way are generally known as *trig* or clinometer heights. In geographical or small-scale topographical maps, heights are fixed occasionally with the hypsometer, and more often with the aneroid barometer.

Contouring, controlled by the bench marks of the spirit levelling or the trig clinometer or barometric spot heights, may be filled in in a variety of ways. The most accurate method is to level, up or down, from a bench mark to any spot at the height of the contour required, and then to mark the contour on the ground by pegs, between each pair of which the level is set up. The positions of the pegs are then surveyed. The *water level* may be used for this *tracing* process. In engineering surveys, contours are generally sketched in between the number of fixed positions and heights provided by tacheometric surveying. In topographical surveys, contours are sketched in from a control of clinometer heights. The accuracy of the contouring in engineering and topographical surveys depends largely on the practice and skill of the surveyor. They may be indistinguishable from spirit- or water-levelled contours, and they may, on the other hand, be mere form-lines.

The magnitude of errors to be expected in ordinary survey processes

(*a*) Expressed as fractions of the lengths measured :	
1. Geodetic base ..	1 : 1,000,000.
2. Triangulation :	
Primary	1 : 50,000.
Secondary ..	1 : 20,000.
Tertiary or topographical	1 : 5000.
3. Traversing : measurement of side with steel band	1 : 5000.
4. Chaining (Gunter's chain)	1 : 500 to 1 : 1000.
5. Tacheometry ..	1 : 500.
6. Stereophotogrammetry	1 : 200 to 1 : 1000.
(*b*) Expressed as absolute quantities :	
1. Measurement of an angle with modern 10-inch or 12-inch transit theodolite (32 values) ..	0·4 second.
2. Measurement of an angle with modern 5-inch transit (16 values)	2·0 seconds.
3. Precise levelling (in feet	0·007 $\sqrt{\text{miles}}$.
4. Engineering levelling	0·07 $\sqrt{\text{miles}}$.
5. Astronomical latitude (including local attraction) ..	200 feet.
6. Astronomical longitude (with wireless determination of Greenwich time)	200 feet.

Note.—Older methods of obtaining longitude astronomically, by occultations, transit of chronometers, etc., gave results of much less precision.

BIBLIOGRAPHY : (Precise Control Work) Mansfield Merriman, *Elements of Precise Surveying and Geodesy* ; (Topographical Surveying) Colonel C. F. Close, *Text Book of Topographical Surveying* ; H. M. Wilson, *Topographical Surveying* ; (Geographical Surveying) A. E. Reeves, *Hints to Travellers* ; (Engineering Surveys) Norman Thomas, *Surveying* ; (Photogrammetry) E. Deville, *Photographic Surveying* ; Lieutenant-Colonel M. N. MacLeod, *Mapping from Air Photographs* ; Dr. C. Pilfrich, *Stereoskopisches Sehen und Wissen* ; Wharton and Field, *Hydrographical Surveying* ; G. L. Leston, *Land and Mine Surveying*.

SUSA. An ancient city of Persia, the capital of the province of Susiana (Elam). It was situated in the plain between the Kerkha (Choaspes) and the Dizful. It was a very extensive city, with a strongly fortified citadel, containing the palace (see Esther, i., 4-6) and treasury of the Persian kings, whose chief residence it was from the time of Darius I. It is the Shushan of Daniel (viii., 2) and Nehemiah (i., 1).

SUSA (ancient **Hadrumetum**). A seaport of Tunisia, on the Gulf of Hamáma. The chief exports are oil, grain, phosphates, sansa (olive refuse), and esparto. Pop. 21,298.

SUSANNAH, BOOK OF. One of the apocryphal additions to the book of Daniel which are found in the Greek versions of Theodotion and the Seventy. They have not been found in any Hebrew original, and are generally rejected by the Jews. It is the story of a beautiful and virtuous woman loved by two Jewish elders, whose proposals she rejected ; accused of adultery by the two rejected lovers, her innocence was proved by Daniel.

SUSPENSION. In music, the prolongation of a note in a chord, having the effect of suspending for a moment certain notes in the following chord ; or the delay of a dissonance in reaching the chord into which it is to be resolved.

SUSPENSION AND INTERDICT. In Scots law, a judicial remedy which may be applied for in the Court of Session, where the object is to stop some act or proceeding. The applicant for a note of suspension and interdict must prove

that he is interested in the act or proceeding complained of.

SUSQUEHAN'NA. A river of the United States, formed by two branches, an eastern or northern branch, 350 miles long from Lake Otsego in New York, and a western branch, 250 miles from the western slopes of the Alleghanies, which unite at Sunbury, in Pennsylvania. The united stream, after a course of 150 miles, reaches the head of Chesapeake Bay. It is a wide, shallow stream, with a drainage area of 27,660 sq. miles, but it is generally unnavigable.

SUSSEX. A southern maritime county of England, with a coast-line of 91 miles on the English Channel; area, 932,471 acres. The rivers—the Arun, Adur, Ouse, and Rother—flow to the English Channel. The great physical feature of the county, the South Downs (Ditchling Beacon, 813 feet), is chiefly used for rearing the famous South Down sheep. To the north of the South Downs range is the valley of the Weald, which forms the larger part of the county, whose eastern boundary overlaps the Kentish hop area.

Agriculture is progressive, and a considerable area is under timber. Numerous health-resorts and watering- or bathing-places are found along the Sussex shores, e.g. Brighton, Hastings, Eastbourne, Worthing, Littlehampton, Shoreham, Bexhill, Hove, and Bognor. The county is rich in archæological remains, among which are the castles of Pevensey, Bodiam, Hastings, Arundel, Bramber, and Hurstmonceaux. Pop. (1931), 770,078.

SUTCLIFFE, Herbert William. English cricketer, born at Summersbridge, near Harrogate, 25th Nov., 1894; he first played for Yorkshire in 1914. In 1924, having made a great reputation as a batsman, he went to Australia and in the succeeding test matches, down to 1930, with one or two exceptions, he and Hobbs opened the batting for England in a partnership that has become historic. His batting averages in test matches are unique; in 1930 it was 87·2 and he has scored seven centuries against Australia. In 1930 he scored 3006 runs, and in each season since 1919 he has exceeded 1000. In June, 1932, Sutcliffe and Holmes established a record by scoring 555 runs in a first-wicket partnership for Yorkshire against Essex, Sutcliffe's score being 313.

SUTHERLAND (*suth'*ĕr-land). A maritime county of Scotland, extending between the North Sea and the Atlantic; area, 1,297,914 acres. The interior consists of an ancient dissected plateau (Ben More, 3273 feet), with picturesque valleys and glens and broad moorlands. Along the west coast there are several fine sea-lochs. Dornoch is the county town. Dunrobin Castle is the seat of the Duke of Sutherland.

The principal streams are the Oykell, Brora, Helmsdale, Halladale, Naver, and Hope. The principal lochs are Loch Shin, Loch Naver, Loch Hope, Loch Assynt, and Loch More. There are valuable salmon fisheries in several of the rivers. The greater part of the county is fitted only for grazing, but on the eastern coastal plain oats and barley are cultivated, and even wheat has been raised. Timbered areas of birch, alder, oak, fir, larch, and other trees have been formed. Game (grouse, etc.) is abundant, and there are extensive deer forests. The herring fishery is important. Pop. (1931), 16,100.

SUTHERLAND, Duke of. Scottish title borne by the family of Leveson-Gower. The title of Earl of Sutherland, a very old one, was inherited in 1766 by Elizabeth Gordon, who married George Granville Leveson-Gower. In 1803 he became Marquess of Stafford, and in 1833 was created Duke of Sutherland. His successor, George, who became the fifth duke in 1913, was a member of the Unionist Government, and took a special interest in the Air Force. The duke owns a great deal of land in Sutherlandshire where he has a splendid seat, Dunrobin Castle. His English seat, Trentham Hall, has been pulled down, and his London house is now the London Museum. His eldest son is called the Marquess of Stafford.

SUTLEJ. One of the "five rivers" of the Punjab, India, rising in Tibet, in the Himalayas, at an altitude of over 15,000 feet. Passing through the Himalayas, it flows south-west, and enters the Indus at Mithankot after a course of about 900 miles. See map under PUNJAB.

SU'TRAS (Skt., "threads"). In Sanskrit literature, the name given to the numerous series of religious aphorisms and rules, including all the ritual, grammatical, metrical, and philosophical works, and consisting of brief sentences to be committed to memory.

SUTTEE' (Skt. *satī*, an excellent wife). A European term applied to the self-immolation of Indian widows on the funeral pile of their deceased husbands. The origin of this practice is of considerable antiquity, but it

is not enjoined by the laws of Manu, nor is it based on the Vedas. It was abolished by Lord William Cavendish-Bentinck, afterwards first Governor-General of India, in Dec., 1829, but cases are still occasionally heard of.

SUTTON. An urban district of Surrey, England, 11¼ miles from London. Pop., with Cheam (1931), 46,488.

SUTTON BRIDGE. District of Lincolnshire. It is on the Nen, near the Wash, 7 miles from Wisbech and is a river port and a railway junction. Near is Long Sutton, a village with an old and beautiful church. Pop. (1931), 2837.

SUTTON COLDFIELD. A municipal borough of Warwickshire, England. Pop. (1931), 29,924.

SUTTON COURTENAY. Village of Berkshire. It is 2½ miles from Abingdon and quite near the Thames. There is an old church restored and a fourteenth-century manor house.

SUTTON-IN-ASHFIELD. An urban district and market town of Nottinghamshire, England. Manufactures include cotton, hosiery, and thread.

SUTTON-ON-SEA. Pleasure resort of Lincolnshire. It is 30½ miles from Boston and 147¾ from London, on the L.N.E. Rly. There are excellent sands.

SUVA. The capital and seaport of the Fiji Islands, on Viti Levu. Pop. (European), 1741.

SUVALKI. A town of Lithuania, 75 miles S.W. of Kovno. It is at present occupied by Poland. Pop. 31,600.

SUVLA BAY. Inlet of the west coast of the Gallipoli Peninsula, where the Gulf of Saros joins the Ægean Sea. On 7th Aug., 1915, a British force was landed here as a part of an allied offensive against the Turks. It was hoped that this force would succeed in taking the Anafarta Hills and link up with the Australian forces on its left. Difficulties of transport and water supply as well as casualties due to dysentery caused the failure of this plan. The position was successfully evacuated on Dec. 20.

SUVO'ROF-RYMNIKSKI, Peter Alexis Vassilivitsh (his name is also spelled *Suwarof*, *Suwarrow*, etc.). Count of, Prince Italiski, field-marshal and generalissimo of the Russian armies, born about 1729 or 1730, died in 1800. In his seventeenth year he entered the service as a private soldier. He served in the war against Sweden, in the Seven Years' War, in Poland, and against the Turks, giving many proofs of courage and ability, and obtaining the rank of lieutenant in 1754, of lieutenant-colonel in 1763, of brigadier-general in 1768, and of general of division in 1773. In 1783 he reduced the Kuban Tatars under the Russian yoke.

In 1787, as chief in command, he conducted the defence of Kinburn to a successful issue; and in 1789 he gained the dignity of count by his great victory on the banks of the Rymnik, where the Austrian troops, under the Prince of Saxe-Coburg, were surrounded by 100,000 Turks. By his timely arrival with 10,000 Russians he not only rescued the Austrians, but occasioned the utter overthrow of the enemy. The next, and perhaps the most sanguinary of his actions, was the storming of Ismail in 1790, which was followed by the indiscriminate massacre of 40,000 of the inhabitants of every age and both sexes. He was next employed against the Kingdom of Poland, and conducted a campaign of which the partition of the country was the result, receiving a field-marshal's baton and an estate in the dominions which he had contributed to annex to the Russian Crown.

The last and most celebrated of his services was his campaign in Italy in 1799, when his courage and genius for a while repaired the disasters of the allied forces. He gained several brilliant victories at Piacenza, Novi, etc., drove the French from all the towns and fortresses of Upper Italy, and was rewarded with the title of Prince Italiski. But in consequence of a change in the plan of operations he passed the Alps; and the defeat of Korsakov at Zurich, together with the failure of the expected assistance from the Austrians, obliged him to retreat from Switzerland. On his recall to Russia, preparations were made for his triumphal entry into St. Petersburg (Leningrad); but having incurred the displeasure of the Emperor Paul, the preparations for his triumph were suspended.

SVENDBORG. A seaport of Denmark, on the Island of Funen. Pop. 14,419.

SWADLINCOTE. Urban district of Derbyshire. It is 4½ miles from Burton-on-Trent and 126 from London, on the L.M.S. Rly. In the urban district are Stanton and Church Gresley. Coal-mining is the principal industry. Pop. (1931), 4302.

SWAFFHAM. Market town and urban district of Norfolk. It is 93 miles from London, on the L.N.E.R.

The town is an agricultural centre. Pop. (1931), 2783.

SWAHILI. A name given to the inhabitants of a considerable part of the coast of East Africa and the adjacent islands, a people of mixed Arabic and native African origin.

SWAKOPMUND. A port and holiday resort in South-West Africa, 25 miles N. of Walvis Bay. Pop. 1772 (1078 white).

SWALLOW. The general name for all the insessorial birds of the family Hirundinidæ, distinguished

Swallow

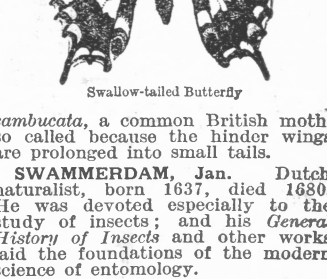
by their long and powerful wings, their short broad beak, their wide gape, their comparatively small and weak legs and feet, and their habit of hawking on the wing for insects, which constitute their food.

They are found all over the world except in the coldest regions, and there are a number of species. Three are British, the common or chimney swallow (*Hirundo rustica*), the house-martin (*H. urbica*), and the sand-martin (*H.* or *Cotile riparia*). The common swallow has the nostrils concealed by a membrane in front, and the outer feathers of the tail much elongated. It is about 8½ inches in length. The top of the head is reddish-chestnut in colour, the back and wings being steel-blue. The tail and secondary feathers are black, a dark-blue patch existing at the upper part of the chest, whilst the throat is a chestnut-brown. The beak, legs, and toes are black, and the under parts are white or greyish. The females possess the chest-patch, and also the forehead patch of red, of smaller size than the males. The song is at best a mere twitter. The nest consists of a cup-shaped structure of mud or clay, sometimes built a few feet down an unused chimney, often close under the roof of some outhouse to which ready access is obtained, and is lined inside with soft grasses, feathers, and other materials.

The migration of the common swallow has always attracted attention from the well-known and unvarying character of the movements of these birds. In Britain they fly southwards about the end of October, or sometimes sooner, to winter in Africa, some finding their way to India, and they arrive again in Britain in the succeeding April. They generally return to the nests they have constructed, and appear to exhibit great distress on finding their former home swept away.

Swallows bear a considerable resemblance to swifts (q.v.), and among the swifts are several forms which are popularly named "swallows." Thus the bird known in North America as the chimney swallow is not a true swallow, but a swift (*Chætūra pelagica*). The swallow that produces the edible nest is also a swift. Of true swallows, however, several are American, and among them the barn swallow (*H. horreorum*), very similar to the European chimney swallow, the purple martin (*Progne subis*), and the cliff swallow (*Petrochelīdon lunifrons*). The name of "sea swallow" is given to the tern (q.v.). *See* MARTIN; SAND-MARTIN.

SWALLOW-TAILED BUTTERFLY AND MOTH. Names given to the *Papilio machaon*, a beautiful species of butterflies, and to the *Uropteryx*



Swallow-tailed Butterfly

sambucata, a common British moth, so called because the hinder wings are prolonged into small tails.

SWAMMERDAM, Jan. Dutch naturalist, born 1637, died 1680. He was devoted especially to the study of insects; and his *General History of Insects* and other works laid the foundations of the modern science of entomology.

SWAN, Sir Joseph Wilson. English inventor, born at Sunderland in 1828, died in 1914. His inventions include

rapid dry plates, bromide paper, the carbon or autotype process, and other improvements in photography, the incandescent electric lamp, a miners' electric safety lamp, and improvements in photo-mechanical printing and electro-metallurgy. He was a Fellow of the Royal Society and a Chevalier of the Legion of Honour, and received the honour of knighthood in 1904.

SWAN (Cygnus). A genus of swimming birds, sub-family Cygninæ of the duck family (Anatidæ), distinguished as a group by the bill being of equal length with the head, and broad throughout its length; by the *cere* being soft; by the front toes being strongly webbed, whilst the hinder toe is not webbed, and has no lobe or under-skin.

The species which inhabit or visit Britain are the mute or tame swan (*C. olor*), the whooper, whistling, or wild swan (*C. musicus*), and Bewick's swan (*C. bewicki*). The mute or tame swan, so named from having little or no voice, is the only species which is permanently resident in Britain. The nest is constructed of reeds and grasses, and is generally situated near the edge of the water on some islet. The young ("cygnets") when hatched are of a light bluish-grey colour. The food consists of vegetable matters, smaller fishes, worms, etc., and fish-spawn. The wild swan and Bewick's swan pass the winter in Great Britain, flying northward in the spring. The first is a native of Iceland, Eastern Lapland, and Northern Russia; the second has its home farther east.

They have their representatives in North America in the trumpeter swan (*C. buccinător*) and the *C. columbianus*. South America produces one very distinct species, the beautiful black-necked swan (*C. melanocoryphus*). The black swan (*C. atrātus*) of Australia, like the white swan, is frequently kept as an ornament in parks or pleasure-grounds. Its large size, and the gracefulness of its form and motions, render the swan one of the most ornamental of all the water-birds.

In England, from a very early date, it has been specially protected by both legal and regal interference. In Henry VII.'s reign the theft of a swan's egg was deemed an offence punishable by a year's imprisonment. Swans themselves, at a prior date, were declared to be exclusively "royal" or "king's" property; and no subject was entitled to hold possession of these birds save under special favour from the sovereign. To such subjects as possessed the permission to keep swans a special or "swan" mark was attached, and this mark was cut on the bill of the bird as a distinctive badge of ownership. The process of marking is known as "swan-upping" or "hopping," and the ceremony is yet annually carried out on the Thames on behalf of the Crown, and certain of the London guilds or companies.

SWANAGE. An urban district, watering-place, and seaport of Dorset, England, on Swanage Bay. Quarrying is the main industry; the shipping is negligible. Pop. (1931), 6276.

SWAN RIVER. A river of Western Australia, which colony was founded (1829) as the "Swan River Settlement." Perth, the capital of the colony, is on the Swan River, and Fremantle is at its mouth.

SWANSDOWN. A name for a fine, soft, thick woollen cloth, or for a thick cotton cloth with a soft nap on one side, obtained in both cases by a process of raising. The weave for swansdown fabrics is generally the one up, three down, broken twill.

SWANSEA (W. *Abertawe*). A county and municipal borough of Glamorganshire, South Wales, on the Tawe at its entrance into Swansea Bay (Bristol Channel). Copper-working was once the chief industry in the borough, but the development of adjacent coal-fields and the fact that copper is now smelted as near the mines as possible have brought about a decline in the copper industry and a corresponding rise in those of iron and steel. Tin-plates, steel-tubes, etc., are made.

Not only is Swansea a great distributing centre for coal transported by sea, and one of the foremost bunkering ports of Britain, it is also one of the world's foremost oil-delivery depots.[1] There are 282 acres of docks, with 32,000 linear feet of quays, 27 coal-hoists, 120 cranes, and 750,000 sq. feet of warehouses and sheds. Pop. (1931), 164,825.

SWARAJ. A term consisting of two Hindu words which together mean "self-mastery" or "self-government." Since about 1920 it has been accepted by the Indian Nationalists to express their aim of self-government for India. The desire for Swaraj was greatly stimulated by the Indian share in the European

[1] At Llandarcy, near Swansea, is a refinery of the Anglo-Persian Company. It covers 650 acres, and has a model village attached. From Persia the crude oil is brought to Swansea in oil-tankers; three ships can discharge simultaneously to the transit tanks, whence the oil is pumped to Llandarcy.

War. There have been in India three parties in the nationalist movement: (1) political extremists who virtually boycotted the Montagu-Chelmsford reforms; (2) a moderate party working with the government in the reforms, but with the same ultimate end in view as (1); and (3) Gandhi and his party, whose aim is the strengthening of national character.

SWATOW'. A treaty port of China, in the province of Kwang-tung, at the mouth of the Han River. It was opened to foreign commerce in 1869. The principal exports (mainly to Hong-Kong) are sugar, paper, tobacco, and tea. Pop. 141,063.

SWAZILAND. A small native state in South Africa, under British control, on the south-east of the Transvaal; area, 6705 sq. miles. It is mountainous, and has great mineral wealth. Gold, coal, and alluvial tin (cassiterite) are found. Tobacco, maize, millet, ground-nuts and beans, etc., are raised. Mbabane is the administrative centre, and maintains tri-weekly motor communication with Bremersdorp and Carolina, the only transport in the country except small carts and runners. The Swazis are of the Zulu race, and have always been friendly to the British. Pop. 112,951 (2205 Europeans).

SWEATING SICKNESS. An infectious disease which manifested itself in severe epidemic outbreaks in England during the fifteenth and sixteenth centuries. More recent outbreaks on the continent of Europe have not been widespread or of long duration. The profuse perspiration which characterises the disease lasts until convalescence. There is also an eruption resembling millet-seeds, which has given the name *miliary fever* to the disorder. A high mortality marked the outbreaks in mediæval England.

Swansea: View of the Harbour

SWEATING SYSTEM. Originally a slang expression applied to a system of sub-contracting work, especially in the clothing trade, to poorly paid workers in their own homes. About the year 1850 Charles Kingsley and the Christian Socialists, with the help of the *Morning Chronicle*, carried on a vigorous campaign against the "sweating system," which Kingsley denounced in his tract *Cheap Clothes and Nasty; by Parson Lot*, and in *Alton Locke*. In the tract Kingsley described the system in the following terms: "Part of the work, if not the whole, is let out to contractors or middlemen—sweaters, as their victims significantly call them—who, in their turn, let it out again, sometimes to the workmen, sometimes to fresh middlemen; so that out of the

price paid for labour on each article, not only the workmen, but the sweater, and perhaps the sweater's sweater, and a third, and a fourth, and a fifth, have to draw their profit." Kingsley and his friends attempted to combat this evil system by forming co-operative workshops, which, however, were not very successful.

In 1888 a select committee of the House of Lords was appointed to inquire into the subject of sweating. They found that the name was applied to: "(1) A rate of wages inadequate to the necessities of the workers, or disproportionate to the work done; (2) excessive hours of labour; (3) the insanitary state of the houses in which the work is carried on." They reported that, "As a rule, the observations made with respect to sweating apply, in the main, to unskilled or only partially skilled workers, as the thoroughly skilled workers can almost always obtain adequate wages."

The Trade Boards Act of 1909 was the result of a parliamentary inquiry into sweating, instigated in 1906 by Sir Charles Dilke, after a series of exhibitions had been organised by the Anti-Sweating League. This Act applied at first to four trades—chain-making, lace-finishing, box-making, and tailoring—but it has since been extended to others. It sets up boards, consisting of employers and workers in equal numbers, whose duty it is to fix minimum rates of wages for time- and piece-work in the trade concerned. The rates so fixed become obligatory, by order of the Board of Trade, six months after they have been made by the Trade Board.

For the benefit conferred on the workers by this legislation, see *Board of Trade Report* (H.C. 134).

SWEDEN (Sw. *Sverige*). A kingdom of North Europe, forming the eastern and largest political division of the Scandinavian Peninsula. For administrative purposes it is divided into twenty-five län or governments. The total area is 173,356 sq. miles (3509 being occupied by Lakes Vänern, Vättern, Mälaren, and Hjälmaren), and the population in 1931 was 6,087,923. Stockholm is the capital, pop. (1932), 514,333; other towns and their populations (1932) are: Göteborg (247,911), Malmö (129,927), Norrköping (61,799), Hälsingborg (56,620), Gävle (38,992), Boras (38,976), Orebro (37,968), Eskilstuna (32,754), Jönköping (31,290), Uppsala (30,741), Västeras (30,649), Linköping (30,377). Malmö, Göteborg, and Stockholm are the chief seaports.

Physical Features. The old Scandinavian plateau falls in terraces to the Gulf of Bothnia. The great number and large volume of the Swedish rivers are explained by the character and position of the main watershed, and their general south-easterly trend is determined by the slope of the plateau. The terraces cause at least three falls or rapids in each river between source and mouth. Between Tornea (Tornio) and Gefle over sixty important rivers empty to the sea. The Plain of Scania, occupying the whole of the southern peninsula between the Sound on the west and the Baltic on the south and east, is the chief agricultural and industrial region.

The chief lakes are Vener (area, 2014 sq. miles), Vetter (715 sq. miles), and Mälar, which has the capital on its shores. By canal, lake, and river there is an inland waterway—the Göta Canal—from the Kattegat to the Baltic. Sweden trends roughly from north to south, and the climate varies with the latitude, but generally the climate is dry and bracing; at Stockholm the average annual temperature is 42° F. The Baltic ports are frozen for many months of each year.

Communications. In 1931 there were 16,770 kilometres of railway in Sweden, of which 6753 kilometres are privately owned, the remainder being operated and controlled by the Government. All State lines are on the 4-ft.-8½-in. gauge, and the tracks are chiefly single. The State lines have a central administration, and comprise the northern trunk line (Stockholm and east coast) with many feeders, and a line, Bräcke-Ostersund-Storlien, where a Norwegian line connects with Trondjem. Hydro-electric power is utilised in Lapland for the operation of the Lulea-Boden-Riksgränsen-Narvik (Norway) line, which is essential to the life of the iron-mines of this region, whose only outlet is by Narvik; and also for the line between Göteborg and Stockholm. Other State-operated trunk lines ex Stockholm run to Malmö, Göteborg, Oslo, etc. The eastern line to Lulea is continued via Boden to Haparanda, and through connection is provided for Finland and Leningrad via Tornio (q.v.). *See also* ULEÅBORG; UPPSALA.

A daily aerial service is maintained between Stockholm and Helsingfors, and between Malmö and Amsterdam.

Production and Industry. Activity is divided almost equally between industry and agriculture. An economic division of Sweden by a hypothetical line drawn east and west between the mouth of the Dal

and that of the Klar would show a land of mining and forestry to the north, and a busy farming and factory region south of it.

Agriculture. Sugar-beet, fodder, rye, oats, and potatoes are important.

Mining. Iron, coal, sulphur pyrites, and zinc, copper, manganese, and argentiferous lead ores are chiefly mined.

Forestry. More than a half of the total area of Sweden is afforested, but the chief forestry region lies between 60° and 64° N. lat. Swedish timber and wood-pulp production is of world-wide importance.

Manufactures. The shores of the Gulf of Bothnia are the site of Sweden's chief sawmills. Domnarvet, Uddeholm, Sandviken, and Fagelsta produce pig-iron. Dairy supplies, telephone supplies, lighthouse apparatus, and machinery, porcelain, glass, paper, pasteboard, furniture, electrical machinery, and chemicals are other representative manufactures.

People. The inhabitants of Sweden, with the exception of the Laplanders and the Finns, found only in the north, belong to the Scandinavian branch of the Teutonic family. The Lutheran faith is recognised as the State religion, but other religions are tolerated. There are 5,880,941 Lutherans, 12,717 dissenters (Protestant), 3425 Roman Catholics, and 6469 Jews. Elementary education is free and compulsory between the ages of seven and fourteen years. There are two universities, Uppsala and Lund respectively.

Government, etc. The crown is hereditary in the male line of the Royal House of Ponte Corvo. The king must be a member of the Lutheran Church. Legislative power is exercised, in concert with the sovereign, by the Diet, which alone is empowered to levy taxes. The Diet comprises two elective chambers. The First (or Upper) Chamber consists of 150 paid members, elected for nine years. The Second Chamber consists of 230 paid members, elected by universal suffrage for four years. Travelling expenses of the Deputies of both Houses are paid by the public purse. Executive power is in the hands of the king, under the advice of a Council of State consisting of about ten members, chiefly departmental heads. Stockholm is placed under a Governor-General, and each of the other län under a prefect, nominated by the king.

Currency, etc. The unit is 10 *kronor* gold; one *krona* = 100 *öre*: the par rate of exchange is kr. 18·16 = £1 sterling. The metric system of weights and measures is compulsory.

Defence. Military service between the ages of twenty and forty-two years: eleven years with the active army, four years in the second *Uppbad*, and eight years in the Landstorm. There is an air force.

Each division comprises 2 two-regiment brigades (a regiment consisting of 12 battalions and 4 machine-gun companies), a cavalry regiment of 4 squadrons, 1 machine-gun company, and a field-artillery regiment of 11 four-gun batteries, etc. On mobilisation 1 cavalry division of 4 regiments and 1 horse-artillery division are available. The infantry use the Mauser 6·5 mm. rifle; and Krupp 7·5 quick-firing guns are used by the artillery. All ships of the Swedish navy are maintained purely for coastal defence; and there are also land defences in charge of the Royal Coast Artillery. There are 11 ironclads (8 over 20 years old).

History. The history of Sweden before the union of Calmar in 1397 is rather obscure in its earlier part and rather confused throughout. Christianity was introduced by German missionaries in the ninth century, and the first Christian king, Olaf Skötkonung, ascended the throne about 1001, but for some time after there was a keen conflict between the Christian and the Pagan parties. One of the most notable men of this early time was Birger Jarl, a sort of mayor of the palace under Eric the Stammerer (1222-50), who gained so strong a position that he was able to place his son Valdemar on the throne in 1250. Valdemar was dethroned by his brother Magnus Ladulas (1275-90), a vigorous ruler and wise lawgiver.

Sweden and Norway came under the same king in the person of Magnus Smæk, a nephew of Birger, in 1319, and with him began the series of events which led to the union of the three Scandinavian kingdoms under Margaret of Denmark and her nephew Eric of Pomerania (Eric XIII.) in 1397.

Margaret died in 1412, and thereafter Eric XIII. ruled alone, but his incompetence and oppression drove the Swedes to revolt under Engelbrekt Engelbrektsson, and in 1436 he was compelled to appoint Karl Knutsson as regent in Sweden. In 1448 Christian of Oldenburg became King of Denmark and Norway, but the Swedes proclaimed Karl Knutsson king; and after banishments and recalls he died King of Sweden in 1470. Sten Sture the Elder, a nephew of Knutsson, was appointed administrator in 1471, and King Christian was defeated

in an attempt to enforce his claims. Christian died in 1481, and was succeeded by his son Hans, who invaded Sweden and established his authority in 1497. Sture was, however, recalled by the Swedes in 1500, and ruled till his death in 1503.

Christian II. succeeded his father Hans in 1513, and thrice invaded Sweden. Sten Sture the Younger was defeated and mortally wounded, and Christian (q.v.) was crowned at Stockholm in 1520. He signalised his coronation by wholesale executions, notably the Blood Bath of Stockholm, and in consequence a rebellion took place in 1521 under Gustavus Vasa, who in 1523 was proclaimed independent king of Sweden as Gustavus I. (q.v.). He introduced the Lutheran religion as that of the State, and in 1544 he made the monarchy hereditary. He was succeeded by his eldest son, Eric XIV., a cruel and half-insane man, who was deposed in 1568 by his brother John. John ascended the throne as John III., and caused Eric to be poisoned in 1577. He concluded the Peace of Stettin, by which the separation of Sweden from Denmark and Norway was definitely ratified.

John's son, Sigismund, who came to the throne in 1592, was brought up in the Catholic faith in Poland, but he undertook to maintain Protestantism in Sweden. He did not keep his promise, and was deposed in 1599, Duke Charles of Södermanland, youngest son of Gustavus Vasa, being appointed regent. In 1604 the regent was proclaimed king as Charles IX. On his death in 1611 his son, Gustavus II. (Gustavus Adolphus), ascended the throne. This famous monarch, aided by his chancellor, Axel Oxenstjerna, reorganised the administration of the country, promoted industry, commerce, and education, and strengthened the army and navy. He negotiated the conclusion of wars begun by his father against Denmark and Russia, and played a great part in Germany as the champion of Protestantism during the Thirty Years' War (q.v.). He was succeeded by his daughter Christina.

The Peace of Westphalia, which ended the Thirty Years' War (1648), added to Sweden Bremen, Verden, and a large part of Pomerania, while Sweden already possessed on the Russian side of the Baltic, Livonia, Esthonia, and other territories. Christina, who had left the real work of government to Oxenstjerna, abdicated in 1654, leaving as her successor Charles X., son of a sister of Gustavus Adolphus. Charles's short reign (1654-60) was mostly occupied by wars with Poland and Denmark.

Charles XI., son of his predecessor, came to the throne at the age of four. The country was then long under a council of regency, but Charles assumed the government in 1672. He reorganised the army, adopting a regular system of conscription, and restored the finances. He died in 1697, and was succeeded by his son, the celebrated Charles XII. (q.v.). Charles was succeeded by his sister, Ulrica Eleonora, who in 1720 resigned the government to her husband, Frederick I., Crown Prince of Hesse-Cassel. The absolute authority which the Crown had enjoyed under Charles XI. and Charles XII. was checked by the power of the nobles, and Sweden now lost most of her great oversea possessions—Livonia, Esthonia, Ingermanland, part of Finland, etc.

The struggles of the Hats and Caps, the former a war party and the latter in favour of peace, began at this time. On the death of Frederick in 1751 Adolphus Frederick of Holstein-Gottorp was elected king. During his reign the country was distracted by the rivalries of the Hats and Caps, and the royal power sank to a shadow. Adolphus died in 1771, and was succeeded by his son, Gustavus III. (q.v.), whose reign was distinguished by a monarchical revolution. He was assassinated in 1792. His son, Gustavus IV. (q.v.), was deposed, and in 1809 his family declared for ever incapable of succeeding to the crown. His uncle, the Duke of Södermanland, was declared king with the title of Charles XIII. (q.v.). Finland was finally ceded to Russia in 1809.

In 1810 the states elected as Crown Prince, Jean Baptiste Bernadotte (q.v.), Prince of Ponte-Corvo. In the final struggle with Napoleon previous to 1814 Sweden joined the Allies, while Denmark took the part of France. By the Treaty of Kiel (1814) Sweden ceded to Denmark her last German possessions in Pomerania, while Denmark was compelled to cede Norway to Sweden. Norway resisted the cession, and accepted Charles as king only when he had agreed to their free constitution as a separate state. Bernadotte succeeded to the crown in 1818, under the title of Charles XIV. He died in 1844, and was succeeded by his son, Oscar I. (q.v.). He was succeeded by his son, Charles Louis Eugene, under the title of Charles XV., whose reign was marked by constitutional reforms. Charles XV. died in 1872, and was

succeeded by his brother, Oscar II. (q.v.).

In 1905 the union between Norway and Sweden was dissolved (*see* NORWAY). Oscar II. died in Dec., 1907, and was succeeded by his son, Gustavus V. (born 1858), the fifth sovereign of the House of Ponte-Corvo, and a great-grandson of Bernadotte. At his accession Sweden was overrun by Russian intelligence agents, and grave fears were expressed at the Russian concentration in Finland (formerly a Swedish possession), where railways were rapidly converging on the Swedish frontier, and barracks were springing up at every junction. A great wave of patriotism in the form of a national defence movement swept the country, and the reorganisation of the national protective mechanism was proceeding apace at the outbreak of the European War. Strict neutrality having been declared, Sweden was early the focus of great stores and munition movements from abroad to Russia, and later became a central region for trade with the belligerents, particularly Germany. The stringency of the Allied blockade caused a great shortage, and a subsequent rationing of foods.

Sweden joined the League of Nations, and was represented at the first meeting at Geneva (1920); her claim to the Aland Islands was rejected by the League in favour of Finland. The period 1905-14 was one of great commercial growth, but high wages, the eight-hour day, and the economic depression following the European War were reflected in a great industrial crisis during 1921-2.

The temperance question, acute in Sweden, led to a split in the Liberal party, and as a result a Coalition Government held office from 1926 to 1928.

Total prohibition was rejected in 1922. The present control of liquor is the "Bratt system," which entails rationing.

Language and Literature. The Swedish language is akin to Danish and Norwegian, being a descendant of the ancient Norse, the original of the Scandinavian branch of the Teutonic tongues, of which the purest representative at the present day is the Icelandic (*see* SCANDINAVIAN LANGUAGES).

The earliest writings extant are the ancient provincial laws and the oldest ballads, which belong to the thirteenth century. In the fourteenth century translations of the chivalric romances of Southern Europe were introduced, and were followed by Biblical and theological translations and chronicles. The University of Uppsala was founded in 1478, and printing was introduced into Stockholm in 1483. During the sixteenth century the literature, influenced by the Reformation, was chiefly polemical. The earliest translation of the New Testament (1526) was by Olaus Petri, whose brother, Laurentius, the first Protestant archbishop of the kingdom, translated the Old Testament, published in 1541. A Swedish chronicle, *Svensk Krönika*, was written by Olaus and revised by his brother. Olaus also attempted the drama.

The Thirty Years' War exercised a very favourable influence on Swedish literature. Several libraries captured by Gustavus Adolphus were sent into Sweden, and his daughter Christina became a liberal patron of literature, and brought many learned men to the country. The seventeenth century was chiefly characterised by the dramas of Messenius, and by the didactic and other poems of Stjernhjelm, "the father of Swedish poetry" (1598-1672).

In the eighteenth century French and English literature had much influence on that of Sweden. Olof von Dalin (1708-63) now took the chief place in verse and prose, other poets being Hedvig Charlotta Nordenflycht, Creutz, and Gyllenborg. Among the great names of this century in science are those of Swedenborg (1688-1772), Linnæus (1707-78), Torbern Olof Bergman (1735-84), Karl Wilhelm Scheele (1742-86), Celsius (1701-44). Karl Mickel Bellman (1740-95) was a song-writer of great merit. Mörk (1714-63) was the first Swedish novelist.

Berzelius (1779-1844), one of the first chemists of his age, belongs essentially to the nineteenth century, as do Tegnér (1782-1846), Bishop of Vexiö, the greatest name in Swedish literature, whose *Story of Frithiof* was translated into every European language; Frederika Bremer (1801-65), the Finnish poetess, whose stories were popular far beyond Sweden; and Runeberg (1804-77), the poet, who is preferred by many Swedes even to Tegnér.

Among later writers are Zakris Topelius and Count Karl Snoilsky, poets; Rydberg, novelist and historian; Tor Hedberg, Selma Lagerlöf, and Hjalmar Söderberg, novelists; Per Hallström, dramatist and poet; and Strindberg, dramatist and novelist.

Other writers are: Anna Leffler, Ola Hansson, the poet, and Tor Hedberg, the playwright.

BIBLIOGRAPHY: R. N. Bain, *Scandinavia* (*Political History of Denmark, Norway, and Sweden from 1515 to 1900*), and other works; E. B. Kennedy, *Thirty Seasons in Scandinavia*; H. G. Leach, *Scandinavia of the Scandinavians*; J. Stefansson, *Sweden and Denmark* (Stories of the Nations Series).

SWEDENBORG, Emanuel. Swedish scientist and mystic, son of Jesper Swedberg, Bishop of West Gothland, born at Stockholm in 1688, died in 1772. Educated at Uppsala University, he travelled afterwards and studied at Paris, Oxford, and Utrecht. In 1716 he was appointed by Charles XII. assessor extraordinary in the Royal College of Mines, and in 1719 Queen Ulrica raised the Swedberg family to the rank of nobility, the name being changed to Swedenborg. In the discharge of his duties Swedenborg visited the mines of Sweden, Saxony, Austria, and Hungary.

A work on the origin of things, followed by a treatise on mining and smelting (*Opera Philosophica et Mineralia*), was published in 1734 (3 vols.), and attracted much attention among the scholars of Europe. From 1736 to 1740 he travelled in Germany, Holland, France, Italy, and England, and after his return published the *Œconomia Regni Animalis* (Economy of the Soul-kingdom), which contains the application of the system of nature, unfolded in his philosophical works, to man.

He was first introduced to an intercourse with the spiritual world in detail, according to his own statement, in 1743 at London. The eyes of his inward man, he says, were opened to see heaven, hell, and the world of spirits, in which he conversed not only with his deceased acquaintances, but with various distinguished men of antiquity. He resigned (1747) his office in the College of Mines, and subsequently resided much in England and Holland.

His theological works, written in Latin between 1747 and 1771, were not widely read; and although an object of the deepest veneration to his few followers, his statements were the more mysterious to the rest of the world because he could not be suspected of dishonesty, and exhibited profound learning, keenness of intellect, and unfeigned piety. His works are very numerous, among them being the *Arcana Cœlestia*, *The True Christian Religion*, *The Apocalypse Explained*, and *Heaven and Hell*.

SWEDENBORGIANS. The followers of Swedenborg, and particularly the members of what is called the *New Jerusalem Church*, or *New Church*. This body adopts the doctrinal tenets and method of Biblical interpretation laid down in the writings of Emanuel Swedenborg. The first attempt at organisation took place in London in 1783, when John Flaxman, the sculptor, was among its members. The formal organisation of the New Church took place in 1787, and Robert Hindmarsh was chosen to inaugurate the meeting. The first church for public worship was opened in Eastcheap, London, in 1788. Its great apostle was the Rev. John Clowes, rector of St. John's Church, Manchester.

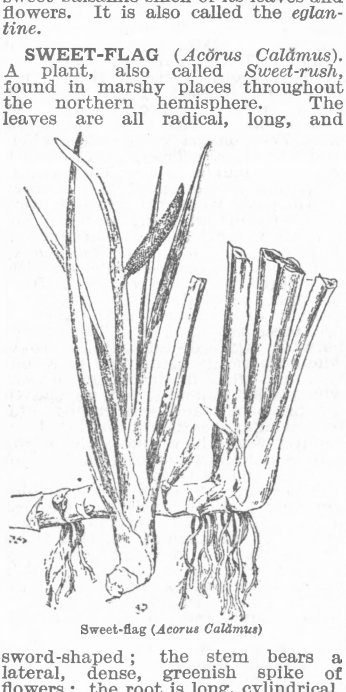
Belief. The belief of the Swedenborgians is: that Jesus Christ is God, in whom is a trinity not of persons but essentials, answering to the soul, body, and the operation of these in a man; that the Scriptures contain an internal or spiritual meaning, which is the Word existing in heaven; that the key to this is the correspondence between natural and spiritual things, as between effects and their causes; that man is saved by shunning evils as sins and leading a life according to the ten commandments; that man is a spirit clothed with a natural body for life on earth, and then when he puts it off at death he continues to live as before but in the spiritual world, first in an intermediate state between heaven and hell, but afterwards, when his character whether good or evil becomes harmonious throughout, among his like either in heaven or hell; that the Lord's second coming and the last judgment are spiritual events which have already taken place. The Swedenborgians have 75 places of worship in Great Britain, with about 6700 members (1932). — BIBLIOGRAPHY: W. White, *Emanuel Swedenborg: his Life and Writings*; G. Trobridge, *A Life of Emanuel Swedenborg*; H. N. Morris, *Flaxman, Blake, Coleridge, and Other Men of Genius influenced by Swedenborg*; W. P. Swainson *Emanuel Swedenborg: the Swedish Seer*.

SWEEPSTAKE. Form of gambling, in which chance or skill wins the combined subscriptions of the competitors. The commonest form is organised on horse-races, in which the horses are drawn by lottery, the prize money being distributed to the winners according to the placing of the horses in the race. As lotteries, sweepstakes are illegal in England, but the London Stock Exchange Sweep is organised by means of a "mutual subscription" confined to

members of a "private club." The Calcutta Sweepstake on the Derby is another private sweep, limited to members of the Royal Calcutta Turf Club, but shares in tickets can be obtained through members. Sweepstakes on a large scale have recently been organised by the Irish Free State. A proportion of the money subscribed is earmarked for Irish hospitals, and the sums yielded have been substantial. In the 1932 Derby Sweepstake the total sum subscribed was £4,184,485, the prize money was £2,804,552, and the hospitals received £516,060.

SWEET-BRIAR, or SWEET-BRIER (*Rosa rubiginosa*). A species of rose, a native of Britain, which grows wild, but is often planted in hedges and gardens on account of the sweet balsamic smell of its leaves and flowers. It is also called the *eglantine*.

SWEET-FLAG (*Acŏrus Calămus*). A plant, also called *Sweet-rush*, found in marshy places throughout the northern hemisphere. The leaves are all radical, long, and



Sweet-flag (*Acorus Calămus*)

sword-shaped; the stem bears a lateral, dense, greenish spike of flowers; the root is long, cylindrical, and knotted. The root has a strong aromatic odour, and a warm, pungent, bitterish taste, and has been employed in medicine since the time of Hippocrates. It is also used by confectioners as a candy, and by perfumers in the preparation of aromatic vinegar, hair-powder, etc.

SWEET-PEA (*Lathŷrus odorātus*). A garden plant belonging to the nat. ord. Leguminosæ, and the sub-order Papilionaceæ. It is cultivated on account of the beauty of its flowers, which are sweet-scented, and in colour purple, rose, white, or variegated. Sicily is said to be its native place.

SWEET-POTATO (*Ipomœa Batatas*; nat. ord. Convolvulaceæ). A plant now cultivated in all the warmer parts of the globe. Formerly the roots were imported into England from the West Indies by way of Spain, and sold as a delicacy. It is the potato of Shakespeare and contemporary writers, the common potato being then scarcely known in Europe. The consumption of the sweet-potato is very large in many parts, including the United States and the warmer parts of America, the East Indies, etc.

SWEET - WILLIAM (*Dianthus barbatus*; nat. ord. Caryophyllaceæ). A species of pink, an old inhabitant of the flower garden, which has produced numerous varieties. It grows wild in dry and sterile places in Middle and Southern Europe.

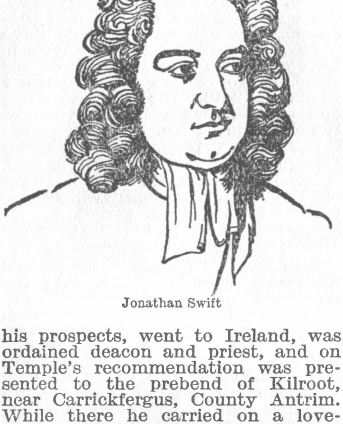
SWELL. In music, a gradual increase and decrease of sound; the crescendo and diminuendo combined, marked by the sign < >. Also an arrangement in an organ (and in some harmoniums) whereby the player can increase or diminish the intensity of the sound at will. In the organ it consists of a series of pipes with a separate keyboard, and forming a separate department (called the swell-organ). The loudness or softness of the tone is regulated by opening or shutting, by means of a pedal, a set of slats like a Venetian blind, which forms part of the frame in which the pipes are enclosed.

SWETLA, or SVĚTLÁ. A town of Bohemia, Czechoslovakia, on the Sazawa: served by the main-line railway Decin (Ger. *Tetschen*)-Vienna and the branch-line Swetla-Rattay. Glass- and starch-making and the cutting of precious stones are the chief industries. Pop. 5000.

SWIFT, Jonathan. British satirist and Dean of St. Patrick's, Dublin, born on 30th Nov., 1667, and died on 19th Oct., 1745. He came of a Yorkshire family, several members of which had settled in Ireland. He was a posthumous child, and was educated at the expense of his uncle, Godwin Swift, who sent him at the

age of six to Kilkenny School, where he met Congreve. At the age of fourteen he was entered at Trinity College, Dublin; he graduated B.A. not without difficulty four years later.

In 1688 Godwin Swift died, and Swift became secretary to Sir William Temple, who was living in retirement at Moor Park, near Farnham. This position brought him early into touch with prominent politicians, but seemed to be a blind-alley occupation. In 1694 Swift left his patron, being dissatisfied with



Jonathan Swift

his prospects, went to Ireland, was ordained deacon and priest, and on Temple's recommendation was presented to the prebend of Kilroot, near Carrickfergus, County Antrim. While there he carried on a love-affair with a Miss Jane Waring ("Varina"), of Belfast; four years later he ended their correspondence with a harsh letter.

He returned to Moor Park in 1696, and found himself more appreciated for having been "lack'd and lost." He remained there until Temple died (1699). During his stay at Moor Park he spent much of his time with Esther Johnson ("Stella"), who when he met her first was a child of eight, being fourteen years younger than Swift. Swift proceeded to Ireland with Lord Berkeley, who, after disappointing Swift twice, presented him to the living of Laracor, near Trim, together with two other small livings, and the prebend of Dunlavin, in St. Patrick's. Stella and her friend Rebecca Dingley soon migrated to Ireland, where Swift saw the former frequently, but always in the presence of a third person.

In 1701 he graduated D.D. at Dublin, and in 1704 he published anonymously *The Tale of a Tub*, which had been written in 1696; to it was appended *The Battle of the Books*. In 1708 appeared, among other things, an attack upon astrology under the title of *Predictions for the Year 1708, by Isaac Bickerstaff, Esq.*, and in 1709 *A Project for the Advancement of Religion*, dedicated to Lady Berkeley, the only work to which he ever put his name.

In 1710 he was in London, being engaged by the Irish prelacy to obtain a remission of the first-fruits and twentieths, payable by the Irish clergy to the Crown, and was introduced to Harley, afterwards Earl of Oxford, and to Secretary St. John, subsequently Lord Bolingbroke. Swift then openly joined the Tory party. He has been much blamed, especially by Whig writers, for his desertion of the Whigs, but to blame him is unfair. Though a Whig in matters of State, he was always a Tory in Church matters; and in his eyes temporal considerations were always outweighed by spiritual. He wrote many political tracts, of which two of the most important were *The Conduct of the Allies* (1711) and *The Barrier Treaty* (1712), which were invaluable to the Tory party, preparing the mind of the country for the peace which the ministers were then anxious to bring about. For his party services Swift desired an English bishopric; but *The Tale of a Tub* was a fatal obstacle, and the only preferment he obtained from his ministerial friends was the Irish deanery of St. Patrick's, to which he was presented in 1713. The quarrels between Oxford and Bolingbroke, whom he vainly attempted to reconcile, and the death of the queen, which soon followed, put an end to his prospects, and condemned him to unwilling residence for life in a country which he disliked, and which was as much a place of exile for him as Tomi was for Ovid.

According to some of his biographers, Swift was privately married to Stella in 1716; others strongly deny this allegation. Whether there was or was not a formal ceremony scarcely whitens or blackens Swift's conduct, which is in either case inexplicable. In 1712 he had become acquainted in London with Hester Vanhomrigh ("Vanessa"), then a woman of twenty-two, interested in books. He guided her reading for some time, and she fell violently in love with him. She made no disguise of her feelings, and followed him to Ireland; he gave her no encouragement, and endeavoured to arrange a suitable marriage for

her, but it was of no avail. The true story of Swift, Stella, and Vanessa is probably less dramatic than many of the extant versions of it. It is clear that Swift was not in the condition

> Of Macheath, between Lucy and Polly,
> Or Buridan's ass.

He merely esteemed Vanessa, but he felt for Stella all the affection which he was capable of feeling. The end of a painful situation came in 1723, when Vanessa wrote a letter to Stella asking her if she was Swift's wife. Stella gave the letter to Swift, who rode off and flung it down upon Vanessa's table without speaking. Vanessa died within a few weeks.

Meanwhile Swift had become the idol of the Irish people by the publication of his *Proposal for the Universal Use of Irish Manufactures* (1720), and of *The Letters of M. B. Drapier* (i.e. Draper) in 1723. *The Drapier's Letters*, as they are usually called, awoke in Ireland, for better and for worse, the dormant spirit of nationality.

Stella died in 1728, and after her death Swift lived a more retired life, and become more and more misanthropic and morbid. He did not, however, relax his efforts to better the miserable condition of the Irish, and dedicated a third of his income to charity. His influence in Ireland was paramount; when it was at its height, he got his servant to announce to some noisy star-gazers that the eclipse had been postponed by order of the Dean of St Patrick's. The crowd, thinking him almost omnipotent, dispersed at once. His own mental eclipse he could not postpone. He became quite insane in 1742, and was with difficulty restrained from tearing out his eye. He grew at length quite tranquil, but sank into a state of idiocy which lasted for three years before it was ended by death. He bequeathed the bulk of his fortune to found a hospital for lunatics.

Works. Turning from Swift's life to his writings, it is possible to mention only his principal works and a few of his innumerable pamphlets. He was a titanic pamphleteer; but although all his writings show ability of the highest kind, many are lacking in interest save to students of the minutiæ of early eighteenth-century history and politics. *The Tale of a Tub* is one of the best and most characteristic of Swift's writings. It is a brilliant satire on Roman Catholics and Puritans, nor does it entirely spare Swift's own Church, whose motto has ever been "medio tutissimus ibis." Many other subjects are satirised besides the Churches; critics and bad writers come in for their share of sarcasm. *The Battle of the Books*, a by-product of the Bentley-Boyle controversy, is a slighter piece, but its considerable merits are not lessened by the fact that Swift was on the wrong side. It is the source of the phrase "sweetness and light."

Gulliver's Travels (1726) is by far the most famous of all Swift's work, and is one of the greatest books in the English language. Its satire becomes more scathing towards the end, the last book being the most powerful indictment of humanity ever penned. *Gulliver's Travels* is one of the most original of books. Its debt to Lucian and Rabelais is of the slightest. Dr. Johnson's criticism upon it that "when once you have thought of big men and little men, it is very easy to do all the rest" is one of the worst utterances of that great critic, who was ever more at home with talent than with genius. By a curious piece of irony, this most bitter of satires has become a nursery classic. To make an Ausonian cento from Juvenal's *Satires*:

> Ut pueris placeat facit indignatio librum.

A Complete Collection of Genteel and Ingenious Conversation satirises the rudeness of would-be smart society. *Directions to Servants* is a good piece of irony, and shows how keen an eye Swift had for details, especially when disagreeable. *An Argument against abolishing Christianity* is a brilliantly ironical pamphlet; *A Letter to a Young Gentleman, lately entered into Holy Orders* throws considerable light on Swift's religious opinions. *The Drapier's Letters*, already mentioned, is a collection of powerful pieces of special pleading. The pamphlet usually called, for sake of convenience, *A Modest Proposal*, is perhaps the most ironical of all ironical writings.

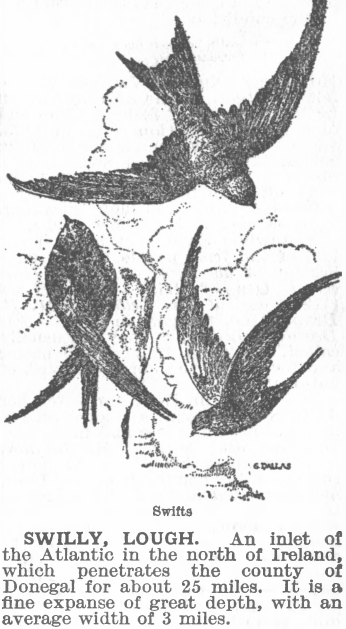
Swift's poems have merit, but not poetic merit. *Cadenus and Vanessa* and some of the poems addressed to Stella are among the most interesting. *On Poetry: a Rhapsody* is a very powerful piece; and *On the Death of Dr. Swift* is a witty and at the same time pathetic poem. Of his other works the *Journal to Stella* is the most important. It gives us an intimate account of Swift's life, and is besides an historical document of the greatest value.

Appreciation. There are three striking characteristics of Swift's writing. He was highly original, owing little to any of his predecessors. He was indifferent to fame, publish-

ing only one of the least of his works in his own name. His wisdom, which was great, was always practical; although so ardent a Churchman, he was always one of the children of this world. As regards style, his writing is well-nigh perfect. It is clear, precise and exact, and absolutely free from rhetorical devices. Swift has been blamed for being too much a misanthrope; but it would be just as fair to blame him for becoming insane. Thackeray very justly said of him: "An immense genius; an awful downfall and ruin! So great a man he seems to me, that thinking of him is like thinking of an empire falling."—BIBLIOGRAPHY: Sir Leslie Stephen, *Jonathan Swift* (English Men of Letters Series); J. Churton Collins, *Jonathan Swift: a Biographical and Critical Study*; H. Paul, *Men and Letters*; Sir Walter Scott, *Memoirs of Jonathan Swift*; Sir Henry Craik, *Life of Jonathan Swift*; W. M. Thackeray, *English Humorists of the Eighteenth Century*; J. Forster, *Life of Jonathan Swift* (incomplete—down to 1711 only).

SWIFT. The *Hirundo apus* of Linnæus and *Cypsĕlus apus* of modern ornithologists, family Cypselidæ. Though swifts are like swallows in many respects, their structure is almost entirely different and they are now grouped with the hummingbirds in a sub-order (Cypseli) of the Coraciiformes. The swift has all four toes directed forwards; it is larger than the swallow; its flight is more rapid and steady; and its scream is very different from the twittering of the swallow. It has the greatest powers of flight of any bird that visits Britain. Its weight is most disproportionately small to its extent of wing, the former being scarcely an ounce, the latter 18 inches, the length of the body being about 8 inches. Its colour is a sombre or sooty black, a whitish patch appearing beneath the chin. It builds in holes in the roofs of houses, in towers, or in hollow trees. It leaves Britain in August, having arrived from Africa early in May.

Species. The alpine swift (*C. melba*), a larger species, with the lower parts dusky white, has its home in the mountainous parts of Central and Southern Europe. A common North American swift is the so-called chimney swallow (*Chætūra pelagica*), which builds its nest in chimneys (*see* SWALLOW). The swifts or swiftlets of the genus Collocalia, which inhabit chiefly the islands of the Indian Ocean from the north of Madagascar eastwards, construct the edible birds'-nests which are used by Chinese epicures in the making of soup.



Swifts

SWILLY, LOUGH. An inlet of the Atlantic in the north of Ireland, which penetrates the county of Donegal for about 25 miles. It is a fine expanse of great depth, with an average width of 3 miles.

SWIMMING. The art of swimming and watermanship is one of the few things that cannot be taught by correspondence. For swimming, the fundamental principle is man's ability to float on or near the surface of water, and all systems of propulsion have this as a necessary basis. In learning, the writer does not favour the system of belts in public baths, except in the case of very nervous children, as these do not inspire confidence in the ability of the learner personally to swim unaided, and progress is retarded at the very period when the greatest strides are necessary. More than that, to many ladies who take up swimming as a tonic-exercise and a body beautifier the belt will not impart anything but increased ungainliness, which may prove hard to eradicate. Sea-water swimming is preferable for learners, as, on account of its density, it offers greater support to the swimmer, and in a pond or bath danger is

reduced to a minimum. The company of good swimmers and an imitation of their methods is very helpful.

The Strokes: *Breast.* This is a very useful stroke, and the one that should be acquired first. In life-saving it is widely used, and it possesses certain advantages over all other strokes that make it one of the best for everyday use. Vision ahead is clear. Leg and arm movements, positive (propulsive) and negative (recovery), are not synchronous, although nine-tenths of swimmers perform them as such. The positive arm movement should be complete as the movement of the legs is begun, and during recovery the muscles both of arms and legs should be allowed completely to relax. It should be remembered that the art of swimming is not a case-hardened method; all strokes may be improved, as may style also, to suit the individual. A movement of the arms vertically downwards, and recovery backwards in alignment with the body, is now favoured by some specialists, and can be recommended for ease and increased style.

Back. A good championship stroke. *Back Crawl.* An inversion of the rhythm and movement of the crawl stroke. Back-stroke swimming has been revolutionised by its adoption, and it has been the means of creating new speed standards for back swimming. It is, however, a stroke that really must be learned young, say between ten and fifteen years.

Crawl. This is quite good up to about 150 yards, and is much favoured for championship use in the United States.

Trudgeon. This is properly *Trudgen*—after the first European user. It is a double over-arm stroke which is much favoured in Great Britain for championship work. *Trudgeon Crawl.* A compound stroke favoured by J. G. Hatfield (cf. *Swimming and Swimming Strokes*, where there are elaborate illustrations).

These are among the most important, but it must be admitted that they are indescribable either verbally or on paper. No two swimmers have identical strokes; they modify each known stroke to suit their individual requirements in speed, comfort, style, and staying-power, and a learner, having duly studied any one of the swimming strokes, must then suit himself as to how he performs it.

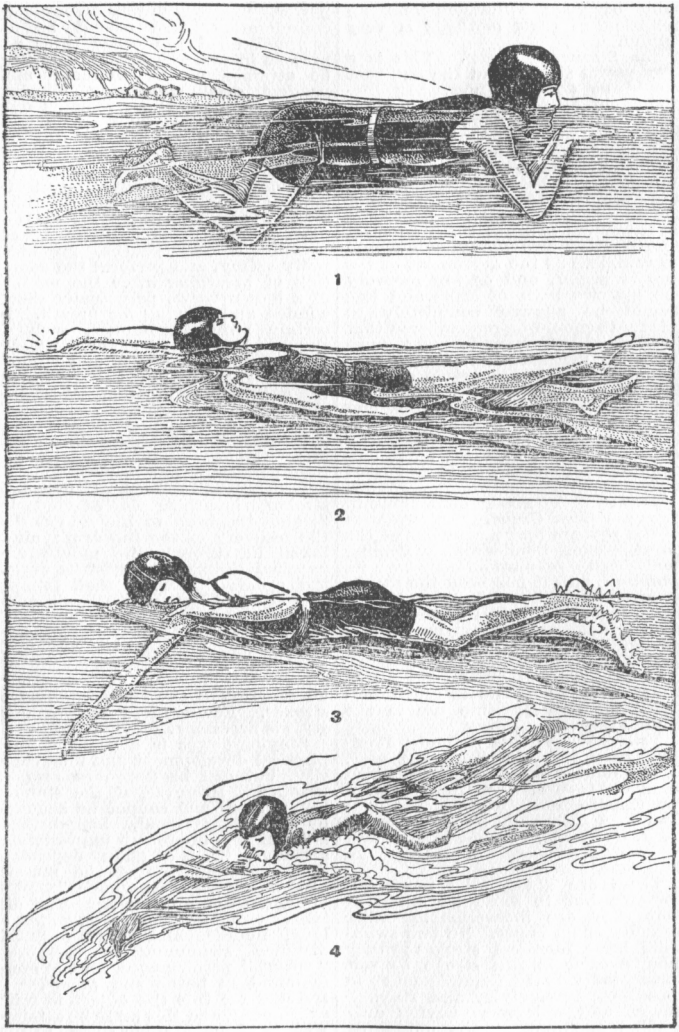
Style. Three great factors combine to make a good swimmer, and of these comfort is perhaps the chief; the others are style and staying-power. Speed is purely a secondary consideration, and cannot be attempted until the other three are present in perfection. Comfort may be attained on a "system," and, passing over emergency ailments such as cramp, there remains only one major source from which it is possible to expect discomfort, and that source is the lungs.

Without proper systematic comfortable breathing there can be neither style, speed, nor anything else. It is perhaps in this matter that most uninstructed amateurs, especially among youths, go most sadly astray, and perform the operation of breathing after the manner of a blown beast, perpetually short-winded and gasping for breath. In certain swimming-strokes, such as the crawl, the head is carried under water for short periods, and it must therefore be within the power of the swimmer to breathe, *not between strokes*, but only after the completion of a cycle of two or more. This should be studied from the outset, after the essential leg-action has been perfected.

Generally, in modern free-style strokes, breathing is effected by flicking the head to the side during the recovery of the top arm; air is taken in through the mouth and expelled through the nostrils during the cycle of strokes that follows. However, in leisurely swims of middle and long distance, one breath to a stroke-cycle may have some advantages, although it has none whatever at racing pace. Style comes by practice, and especially by practice in the correct timing of strokes. For comfort in breathing, style is necessary.

Staying-power is dependent upon physical development and lung capacity, but can be improved also by practice. However, if the stamina is not there and cannot be acquired by the individual, long-distance swimming is almost an impossibility, although in the main dependent upon the capacity of the muscles used in the favourite stroke.

Competition Swimming. The distances to be swum may be stated as long, middle, and short. Short-distance swimming is a purely "sprint" performance, and is much favoured in baths and ponds. In training for this the object is primarily speed, and this must be attained with the least possible effort, so that style, breathing, and all the rest become as one, and are mutually indispensable. For a distance of 100 yards, a distance about one-sixth or so more should be aimed at,



SWIMMING

1, Breast Stroke. 2, Back Crawl. 3, Crawl. 4, Trudgeon.

so that the necessary speed may be maintained throughout the 100 yards, and a little reserve hidden away for the most important stretch in sprint-work—the last 10 yards. 100 *yards* and 100 *metres* are not one and the same thing. Middle and long distances resolve into contests of stamina plus speed. In such races at sea it is sometimes amusing to watch competitors who, head down, wander frequently from their course. Such competitors are usually baths-trained men who are accustomed to the long-coloured bottom- and side-lines of baths (Scotland, America generally, and England in parts), which enable them to steer a direct course. The moral is obvious. Again, in deep sea the resting of muscles may be more complete than in fresh-water swimming, on account of the greater density.

During training all hardening of the muscles is to be avoided; they must be soft and supple, and cycling, etc., is therefore banned. Once the weaknesses of the individual are brought to notice by a stiff swimming-test, concentration may be made to eliminate them; practice, walking, and Swedish exercises will do the rest. Tobacco and alcohol are of necessity taboo. Practice should especially be devoted to the energising of positive strokes and complete relaxation and rest in the negative or preparatory-return movements. The following are some of the free style world records:

Distances	Men		Women	
	Min.	Sec.	Min.	Sec.
100 yards	—	51	1	0⅘
150 ,,	1	25	1	45
220 ,,	2	9	2	39
440 ,,	4	52	5	31⅘
880 ,,	10	22½	12	13⅘
1000 ,,	12	16⅘	13	30⅘
Mile ..	21	6	24	49

The English Channel was first swum by Webb in 1875. Others who have accomplished this feat are Burgess in 1911, Sullivan in 1923, Tiraboschi in 1923, Toth in 1923, Gertrude Ederle, Mrs. Corson, Herr Vierkötter, G. Michel, (11 hrs. 5 mins., a record), and N. R. Denham in 1926, G. H. Temme, Mercedes Gleitze, and Mrs. Gill in 1927, and Hilda Sharp in 1928. All these except Webb, Burgess, and Sullivan crossed from France to England. In 1928 a Channel Swimming Association was formed for the purpose of establishing the authenticity of the various swimmers' claims.

SWIMMING-BLADDER, AIR-BLADDER, or **SOUND** (of fishes). The names applied to a sac or bladder-like structure found in most, but not in all fishes, the chief office of which appears to consist in altering the specific gravity of the fish, and thus enabling it to rise or sink at will in the surrounding water. It has a *homology* or structural correspondence with the *lungs* of higher forms than fishes; but it has no *analogy* or *functional* correspondence with the lungs or breathing organs, save in the peculiar Dipnoi (q.v.) or mud-fishes, in which the air-bladder becomes cellular in structure, and otherwise assumes a lung-like structure and function.

In its simplest condition it exists as a closed sac lying beneath the spine, and containing air or gases of different kinds. By the muscular compression of its walls the density of the contained gas is altered, and the specific gravity of the fish affected accordingly, so as to change its position in the water. In most sea-fishes the gas which the swimming-bladder contains is oxygen, that in the air-sac of freshwater fishes being mostly nitrogen. Such fishes as the flat-fishes, represented by the flounders, soles, etc., have no swimming-bladder developed, and it may be absent in other forms, such as sharks, rays, lampreys, etc.

SWINBURNE, Algernon Charles. English poet and critic, born in 1837; died in 1909. He was educated at Eton, and at Balliol College, Oxford, where he did not graduate, though he took a second class in classical moderations, and won the Taylorian prize. In 1860 he published two tragedies, *The Queen Mother* and *Rosamond*. He visited Italy and made the acquaintance of Walter Savage Landor.

In 1865 he published *Atalanta in Calydon*, considered by many his best work, and, even to lovers of Shelley and Keats, a revelation of the possibilities of English. *Poems and Ballads* (1866) attained notoriety as well as fame, some of the poems being considered improper. *Chastelard* (1865) was part of a Mary Queen of Scots trilogy, of which the other parts were *Bothwell* (1874) and *Mary Stuart* (1881). Swinburne's other poetical works include: *A Song of Italy* (1867); *Songs before Sunrise* (1871); *Tristram of Lyonesse* (1882); *A Century of Roundels* (1883); *Marino Faliero* (1885); *Astrophel and other Poems* (1894); *The Tale of Balen* (1896); and *Rosamund, Queen of the Lombards* (1899).

Swinburne also wrote much literary criticism, all of great interest and value. He delighted in Elizabethan literature, and wrote on Shakespeare, Jonson, Chapman, and some of their contemporaries; but he also wrote upon more recent authors, such as Blake, Charlotte Brontë, and his great idol Victor Hugo. For the last thirty years of his life Swinburne lived a life of great retirement with his friend Theodore Watts-Dunton (q.v.). From 1879 onwards deafness made general society impossible for him. He died after an attack of influenza, followed by pneumonia.

Appreciation. Swinburne takes a high place among English poets.

A. C. Swinburne

As a craftsman he effected in the technique of verse as notable a revolution as Palestrina brought about in music. He found English poetry fettered by iambic measures, and left it dancing gaily in dactylic anapæstic metres. In fact he gave poetry its freedom, not the freedom of *vers libre* (which, it has been said, can no more be called free than sleeping in a ditch can be called free architecture), but that which comes from eager obedience to laws "whose service is perfect freedom." His metrical ingenuity is unsurpassed. Even when using what might be called a toy form of verse like the rondeau, he can write great poetry. It is as if a master-musician played the ocarina, and "in his hand the thing became a trumpet; whence he blew soul-animating strains."

Swinburne's poetry is not, as hostile critics alleged, sound without sense; but the sound is always closely connected with the sense, and sometimes predominates over it. Swinburne is always a singer; he is never a preacher, a philosopher, or a pamphleteer. He derived much inspiration from other poets, and yet remained highly original. He grew poetry in the garden of his mind; he did not manufacture it by the machinery of his mental processes.

As a critic he displayed genius rather than soundness, and is disliked by those who prefer infallibility to suggestiveness. His dicta illustrate the saying that "Out of the same mouth proceedeth blessing and cursing." As a man, Swinburne was a curious instance of one who developed with startling rapidity up to the age of twenty, and then remained fixed in his opinions and beliefs. Jonson has aptly described this type of man: "They are wits of good promise at first, but there is an *ingenistitium*; they stand still at sixteen, they get no higher."—BIBLIOGRAPHY: Paul de Reul, *L'Œuvre de Swinburne*; C. Watts-Dunton, *Swinburne at Home*; E. W. Gosse, *The Life of Swinburne*; J. Drinkwater, *Swinburne: an Estimate*; P. E. Thomas, *Algernon Charles Swinburne: a Critical Study*.

SWINDLING, or **CHEATING,** in English criminal law, is the wilful imposition by a person for gain under pretence of fair dealing. The term includes all varieties of deception for gain against which people cannot guard by ordinary care, e.g. cheating at games, using false weights and measures, coining, obtaining money or goods by false pretences, falsification of accounts, personation, forgery, etc. Cheating at "cards, dice, tables, or other game," whereby any sum of money or valuable thing is won from any person, is a misdemeanour. Every person who uses for trade a weight or measure which is not of the standard denomination, or which is false or unjust, is liable to a fine and, if fraud is involved, to imprisonment also. The offence of coining is punishable with penal servitude for life or imprisonment with or without hard labour. It includes counterfeiting, colouring, impairing, clipping, or filing current coin, and uttering, importing, or exporting counterfeit coin. To make or sell medals resembling current coin is a misdemeanour.

To obtain money or goods by false pretences, or to induce anyone by false pretences to execute a deed, or to sign or endorse valuable securities, is likewise a misdemeanour. This offence has been committed if the party who was induced to part with his money or goods or to sign or endorse his name did so in consequence of words or conduct wilfully designed to mislead and defraud

him by reason of the falsity of the words or conduct. The falsification of accounts by a clerk, officer, or servant with intent to defraud is punishable with penal servitude. Personation, i.e. the pretence of being someone other than one's self for the purpose of obtaining money, etc., is a crime of varying degree. To personate a seaman in order to receive his wages or allowances is punishable with penal servitude; to personate an army pensioner for the purpose of drawing his pension is punishable with two years' imprisonment; to personate an heir, executor, wife, or other relative in order to obtain any land, money, or other property is a felony punishable with penal servitude for life.

Forgery is the making of a false document or of material alterations without authority, or counterfeiting a seal or die, and uttering it as genuine with fraudulent intent. To forge any will, deed, bank-note, or official seal is a felony punishable with penal servitude for life. Less serious forgeries are punishable with penal servitude not exceeding fourteen years or imprisonment. Forgery is commonly thought to consist in the unauthorised signing of another's name, but to alter any part of a document though the signature is genuine, or to place any unauthorised writing over a genuine signature, with fraudulent intent, is also forgery.

SWINDON. A municipal borough, market town, and railway junction of Wiltshire, England. It consists of Old Swindon and New Swindon. Old Swindon, known in *Domesday* as *Swindune*, overtops New Swindon, which originated in the establishment (1841) of the locomotive works of the L.M.S. Railway, which provide the chief employment. Pop. (1931), 62,407.

SWINE FEVER, or **SWINE PLAGUE** (known as **HOG CHOLERA** in America, where it has caused enormous losses). A specific contagious fever, generally rapid in its course, death ensuing in a very few days. To suppress the disease, all affected pigs must be killed, and if necessary those which have been in contact with them, and the carcasses and litter burned or deeply buried.

SWINE IN RELIGIONS. The religious treatment of swine differed among the peoples of ancient Europe and Asia. Lucian in his *De Dea Syria* (chap. liv.), writing of the Galli, says: "They sacrifice bulls and cows alike and goats and sheep; pigs alone, which they abominate, are neither sacrificed nor eaten. Others look on swine without disgust, but as holy animals." In Crete pork was tabooed because Zeus had been suckled by a sow. The Greeks associated the pig with the goddesses Demeter and Aphrodite.

In ancient Egypt swine were kept to eat roots and worms on newly tilled land, and to tread in the grain. Pork was not eaten except once a year, when a pig was sacrificed to the moon and Osiris. Set, the slayer of Osiris, was identified with the black demon-pig, and souls condemned in the Judgment Hall of Osiris were transformed into black pigs. Owing to its connection with Set, the pig acquired an evil reputation. Pork was tabooed for two reasons: (1) because the pig was a form of the mother-goddess, and (2) because it was a form of Set, the Egyptian devil.

The Celts, like the Achæans, ate pork freely, but those who settled in Galatia came under the influence of the Attis cult and tabooed pork. A prejudice against pork still exists among the Christians of Northern Arcadia in Greece, and among sections of the Scottish Highlanders. Apparently the Celts who reached Scotland came under the influence of a cult which tabooed pork. There was formerly a "sow day" in Northern Scotland when pork was eaten, as it was at the Demeter festival in Greece, and the Osirian and lunar festival in ancient Egypt. The god-boar, as well as the devil-pig, has been traced in Scotland. St. Kentigern (St. Mungo), Glasgow's patron saint, followed a white boar, and had a monastery erected on the spot where it tore up the soil with its tusks. On the "boar stone" at Inverness a wild boar is associated with a solar symbol. One of the Pictish tribes was called the "orcs" (young boars). Bronze images of boars were worn on armour by various British tribes. Tacitus tells that the Baltic amber traders of Celtic speech believed that the image of the boar, "the symbol of the mother-goddess" (apparently her son), protected warriors in battle. Christ stamps on the devil-pig on the Ruthwell Cross, Dumfriesshire, and in Scottish Gaelic the devil is "the big black pig." "Were-pigs," referred to as "man-pigs," figure in Scottish and Irish Gaelic tales.

The Jewish, Muslim, and Hindu prejudice against pork is believed to have been of Egyptian and Babylonian origin. Tammuz, the Babylonian god, was associated with the pig. Among the ancient Chinese clay images the god of death stamps on

a pig. The Malay peoples connected the pig with the cowry, and, like the Polynesians, believed in "were-pigs" and in the supernatural pigs from the Underworld.

SWINEMÜNDE (svē'nė-mün-dė). A seaport and sea-bathing resort of Germany, in Prussia, province of Pomerania, on the Island of Usedom, at the mouth of the Swine, the outport for Stettin. The harbour is one of the best on the Prussian Baltic coast. Pop. 18,352.

SWING BRIDGE. A type of bridge which revolves horizontally on a vertical axis which is commonly at its centre, but is sometimes at the end or in an intermediate position in the length. It is one type of movable bridge, the other types being the *bascule bridge*, which is raised in a vertical plane; the

Swing Bridge

retractable drawbridge, which is supported on wheels on tracks on the shore, and can be rolled out of position to permit the passage of traffic through the gap; *lift bridges*, which may be raised to allow passage beneath them; and *transporter bridges*, which are carriages slung from a high fixed structure.

The common swing bridge is supported on a pier at the centre of the gap it crosses, and is turned on a circular track. It leaves a space at each side for the movement of traffic. Unequal arms are sometimes used when the width of the cutting is too small to permit the use of a central pier; and sometimes double swing bridges are installed to obtain the requisite clearance. The bearing may be upon the centre or upon the rim; in the latter case a rim of conical steal bearers is used. The bridges are usually turned by steam-engine or electric motor through a pinion and circular rack. When any pier would be an obstruction, some type of bascule bridge must be resorted to. *See* BRIDGE.

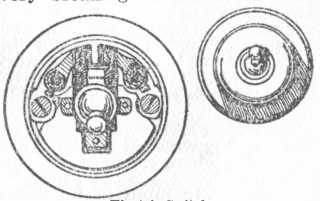
SWINTON. District of Lancashire. It is 5 miles from Manchester, on the L.M.S. Rly., and is part of the urban district of Swinton and Pendlebury. It has large engineering works and cotton mills. Pop. (1931), 32,761.

SWINTON. An urban district and town of England, in the West Riding of Yorkshire. It is an industrial place, with pottery-works, glass-works, ironworks, coal-mines, etc. Pop. (1931), 13,820.

SWISS GUARDS. Bodies of mercenary Swiss troops which, since Switzerland gained her independence in the fifteenth century, have been employed in many European countries as bodyguards, and for duty about courts. The most famous are the French Swiss Guards organised in 1616, and annihilated in the defence of the Tuileries, 10th Aug., 1792, whose heroism is commemorated in Thorwaldsen's colossal Lion, carved in the face of a rock at Lucerne. The French Swiss Guards were reorganised by Louis XVIII. in 1815, and defeated and dispersed in the revolution of 1830.

The Papal Guard (Guardia Svizzera) is another Swiss Guard, consisting of 110 men and 10 officers of Swiss nationality. They form the Papal guard of honour. The privates are not allowed to marry.

SWITCHES AND SWITCH-GEAR. For the purpose of connecting and disconnecting the generators to a supply system, and also the user's equipment to the distributing cables, conducting links which can be put into position in the circuit and drawn away are essential. They range from the simple tumbler switch for operating one of two lights to the heavy equipment used in power-stations. In every case the certainty that complete rupture of the circuit takes place in opening is an essential requirement, and, in consequence, springs are much used to pull the switch-arm into a safe position at every breaking of the circuit. The



Electric Switch

action must be performed suddenly, or arcing between the contacts and switch will ensue, accompanied by destruction of the metal.

For motors working with electricity supply at dangerous pressures, the operating switch is commonly enclosed in an iron box, which is held closed by a catch whenever the switch is on. Large switches in supply-stations are usually arranged to break under oil. When they control high-tension supplies, the actual switch is fitted at the back or

below the switch-board in a brick chamber, the actual opening or closing being effected by the use of systems of levers, or by means of electrical relays. The contact areas of switches must be proportional to the current to be broken, as overheating at those places might make the switch inoperative and be the cause of damage.

Automatic switches or current-breakers serve more than the same purpose as a fuse, although the excess-current type performs similar functions, but with greater certainty. Other types are used to prevent the passage of current back from the supply system to a generator when running light. They are also designed to serve in the cause of safe working in many other ways. In a supply-station all the switches and instruments are brought to a switch-board built up of separate panels for each machine and for each main cable or feeder.

SWITHIN, ST. Bishop of Winchester from 852 to 862, and patron saint of Winchester Cathedral from the tenth to the sixteenth century. The popular knowledge of this saint's name is due to the belief that if rain falls on the 15th of July (which is popularly known as St. Swithin's Day) it will rain for six weeks after. Similar superstitions are connected in various Continental countries with other saints' days which occur in summer.

SWITZERLAND (Ger. *Schweiz*; Fr. *Suisse*). A federal republic of Central Europe, comprising the following cantons:

Canton	Area in Sq. Miles	Population (1930)
Aargau (Argovie) ..	548	259,644
Appenzell (Outer Rhoden)	93	48,977
Appenzell (Inner Rhoden)	72	13,988
Basel-Stadt	14	155,030
Basel-Land	163	92,541
Bern (Berne)	2,657	688,774
Fribourg (Freiburg) ..	644	143,230
Genève (Genf)	108	171,366
Glarus (Glaris)	264	35,653
Graubunden (Grisons) ..	2,746	126,340
Luzern (Lucerne) ..	575	189,391
Neuchâtel (Neuenburg) ..	305	124,524
St. Gallen (St. Gall) ..	785	286,362
Schaffhausen (Schaffhouse)	114	51,187
Schwyz	348	62,337
Solothurn (Soleure) ..	305	144,198
Thurgau (Thurgovie) ..	386	136,063
Ticino (Tessin)	1,085	159,223
Unterwalden { Obwalden	189	19,401
Unterwalden { Nidwalden	106	15,055
Uri	415	22,968
Valais (Wallis)	2,020	136,394
Vaud (Waadt)	1,238	331,853
Zug (Zoug)	92	34,395
Zurich	667	617,706
Total	15,940	4,066,400

The city of Bern is the federal capital; other towns are: Zürich, Bâle, Geneva, Lausanne, St. Gallen, Winterthur, Luzern (Lucerne), La Chaux-de-Fonds, Biel, Neuchâtel, Fribourg, and Schaffhausen. These have all a population of over 20,000, and are arranged in order of importance. Bern is fourth in population.

Physiography. Switzerland is the most mountainous country of Central Europe. It possesses a central plateau, flanked by the Jura and the Alps (q.v.), and from a node on the St. Gothard massif the drainage of the country is swept away to three different seas. The Rhine with the Aar, the Rhône with the Arve, the Ticino (to the Po), and the Inn (to the Danube) are the chief rivers.

Of the many lakes, Geneva is the largest, but, like Constance and Maggiore, it is only partly in Switzerland. Lakes entirely within the country include: Neuchâtel, Morat, Bienne, Thun and feeder, Sempach, Baldegg, Zug, Zürich, and Luzern. All internal lakes belong to the Rhine basin.

Climatically Switzerland has no standard, the altitude and other modifying factors (such as the lakes around the central plateau) gives rise to a condition peculiar to each particular place. As a result there is great diversity of vegetation, and Switzerland is frequently divided by plant characteristics into seven regions as follows:

Region	Altitude Limit in Feet	Characteristics
Lower ..	1800	Vine.
Sub-montane	2800	Walnut trees, spelt, meadows.
Upper mountain ..	4000	Forest timber (beech) barley, oats, pasture.
Sub-alpine ..	5500	Pine and maple forests.
Lower alpine	6500	Alpine pastures.
Upper alpine	*c.*9500	Stunted deciduous trees; no seasonal variation.
Eternal snow	—	Flowering plants found up to *c.* 11,000 feet.

Of the total area 2,317,242 acres are unproductive, 2,315,482 acres are under forests, 3,025,000 acres are under grass and 2,000,000 acres are alpine pasturage.

Agriculture is limited, the chief products being wine, tobacco, cheese, and condensed milk. Forestry is of extreme importance, and pisciculture is a flourishing industry. The only minerals of value are salt and iron. Switzerland is a thriving industrial country and has abundance of cheap hydro-electric power. There were in 1929 8514 factories, and the industrial population was 409,083.

The chief manufactures are hardware, textiles, embroidery, leather goods, silks, electrical machinery, woodwork, paper, chocolate, condensed milk, and above all watches (*c.* 14,000,000 per annum) and clocks (*c.* 10,000,000). Much electric power is exported and great electric development is certain.

In 1932 the value of exports was £30,040,329 (mainly silks, cottons, clocks, machinery, animal food substances, ready-made clothing, ribbons, etc.), and of imports £70,507,152. The corresponding figures for trade with Britain were 5,157,000 and 3,710,000 francs; re-exports amounted to 737,000 francs. Switzerland is a rigid adherent of protection. One of the main sources of Swiss prosperity is the huge hotel industry fostered by the enormous tourist traffic. The currency unit is the *franc* of 10 *batzen* and 100 *rappen* (normal value of franc is *c.* 9½*d.*).

Social Conditions: *People.* Switzerland is an example of a state that is not a nation. In nineteen out of twenty-five cantons German is the common language; French is confined to Freiburg, Vaud, Valais, Neuchâtel, and Geneva; and Italian to Ticino. Romansch, or Rhætian, is spoken by some 43,000 people.

Religion. Religious liberty is assured, but Jesuits and such societies are banned, as is the foundation of new monastic houses or orders. The State may deal summarily with religious organisations that become dangerous to the common weal. 57 per cent of the population are Protestant, and have a majority in the twelve cantons; 41 per cent, with a majority in ten cantons, are Roman Catholic. The Protestant Church is Calvinistic in doctrine, and is controlled by the magistrates of the cantons.

Education. Primary education is secular and compulsory throughout the confederation, but it is not centralised, and although rigidly enforced in the Protestant cantons, it is only nominal in those of Roman Catholic faith. There are seven universities, and a Polytechnic School at Zürich.

Government. By the Constitution of 1874 the executive power is vested in the *Bundesrat* (federal council or cabinet) elected by the Federal Assembly. The parliament, which is the supreme legislative authority, consists of two chambers, the *Ständerat* (Council of States) elected by the cantons, and the *Nationalrat* (National Council) chosen in direct election. The *Bundes-Versammlung*, or Federal Assembly, is the name given to both chambers united. The principles of *initiative* and *referendum* are in use and are frequently acted on. The President of the Confederation and the Vice-President of the Federal Council are elected by the Federal Assembly. The cantons retain their individual sovereignty in all matters affecting cantonal administration. In a few of the smaller cantons there is no parliamentary machinery, the people exercising their absolute sovereignty direct.

The *Landsgemeinde*, an open-air assembly of all male citizens, is held at intervals to pass laws and appoint officials. In the other cantons the functions of the *Landsgemeinden* are exercised by an elective body, the *Cantons Rath*, and in all these cantons the *referendum* is in use, being compulsory in some. The *Bundes-Gericht*, or Federal Tribunal, sitting at Lausanne, is appointed by the Federal Assembly, adjusts disputes between the Confederation and cantons, and between cantons and cantons, and tries persons accused of treason.

Defence. Conscription to the national militia between twenty and forty-eight years is compulsory, infantrymen serving twelve years with the Auszug, eight Landwehr, and eight Landsturm; cavalry have eleven years Auszug and twelve Landwehr. Under training in 1928 were 46,200 men, while a force of 21,000 men garrisons the fortifications in the St. Gothard Pass and in the Rhône Valley. Switzerland could mobilise 200,000 men. There is an air force. The infantry armament is the Swiss repeating rifle, and the artillery have the Krupp quick-firing gun (shielded), 7·5 calibre.

Communications. There are 3367 miles of State railways in Switzerland, and the abundant supply of cheap water-power has promoted an all-electric policy which is pursued whenever possible; in 1932, 1107 miles were electrified. One of the main Swiss lines runs along the Rhône Valley as far as Brig (*see* SYSTEMS, RAILWAY, paragraph 6). From Brig there is an extension, via Münster, as far as Gletsch (29 miles), the station for the Hasli Thal and the Rhône glacier. The St. Gothard trunk line runs to Bellinzona (*see* URI), whence there is a feeder running up the Valle Mesolcina to Lostallo and Mesocco (20 miles). Further lines run via Giubiasco (2¼ miles), whence Locarno (12 miles), Lugano (20 miles), and Luino (24 miles, on the east shore of Lake Maggiore) are served. Lausanne is a considerable railway centre on the north side of the Lake of Geneva, whence lines radiate to Geneva. Fribourg and Bern, and Lyss (v'a Polezieux, Payerne, and Murten).

Fribourg and Payerne are both served by the line to Yverdon on Lake Neuchâtel. Bâle to Luzern (60 miles), via Olten (for Bern and Aarau), is important. Bâle to Olten is 25 miles; Olten to Aarau is 81 miles; and Olten to Bern is 41 miles. From Aarau, Brugg (11½ miles) may be reached, whence lines lead to Bâle (36 miles), Zürich (30 miles, via Baden). Another line from Aarau is that running to Arth-Goldau (40 miles), via Lenzburg, along the valleys of the Bünz and Lorze to Rotkreuz (29 miles, a junction for Luzern); thence by the west shore of the Lake of Zug to Arth.

History. The oldest inhabitants mentioned in written history are the Helvetii (q.v.), who, between 58 B.C. and A.D. 10, were subjugated by the Romans. Before the fall of the Roman Empire in the West, Switzerland was occupied by the German confederation of the Alemanni; by the Burgundians and the Lombards; and by the year 534, under the successors of Clovis, it had become a portion of the Frankish Empire.

Under the successors of Charlemagne it was divided between the Kingdom of France and the German Empire, but ultimately the whole country fell to Germany. For the most part, however, the dependence of Switzerland on Germany was merely nominal. The counts (originally local governors) conducted themselves as princes, assumed the name of their castles, and compelled the free inhabitants of their *Gaus* (districts) to acknowledge them as their lords.

At the beginning of the thirteenth century the three forest cantons of Uri, Schwyz, and Unterwalden were subject to the Counts of Habsburg, who, although they were properly only imperial bailiffs (*Vögte*), yet regarded themselves as sovereign rulers. This claim the three cantons constantly refused to admit, and eventually (1291) leagued themselves together to oppose the usurpation of the House of Habsburg. Tradition says that on the night of 7th Nov., 1307, thirty-three representatives, with Fürst of Uri and his son-in-law Tell, Stauffacher of Schwyz, and Arnold of Melchthal in Unterwalden at their head, met at Rütli, a solitary spot on the Lake of Lucerne, swore to maintain their ancient independence, and projected a rising of these cantons for the 1st Jan., 1308. On the day fixed the rising took place, and the Austrian governors were deposed and expelled. But the events related of Tell are purely legendary.

A few years later the three cantons were invaded by the Habsburgs; but the signal victory at the pass of Morgarten on the 15th of Nov., 1315, secured their independence. The three united cantons were joined by the cities of Lucerne (1332) and Zürich (1351), the cantons of Glarus and Zug (1352), and the city of Bern (1354). Austria, which claimed jurisdiction over three of the newly added members, namely, the city of Lucerne and the cantons of Glarus and Zug, again invaded the territory of the confederation, but was completely defeated at Sempach, where Arnold of Winkelried is said to have sacrificed his life for the sake of his fellow-countrymen (1386), and (1388) at Näfels. The canton of Appenzell joined the confederation (1411) and Aargau was wrested from the Austrians (1415). The third war with Austria terminated in 1460 in favour of the confederation, which obtained Thurgau, Austria being thus deprived of all its possessions in the regions over which Switzerland now extends.

Struggle with Burgundy. In 1474, at the instigation of Louis XI. of France, the Swiss turned their arms against Charles of Burgundy, invading his country and defeating his army near Héricourt. Charles, in revenge, invaded Switzerland, but the Swiss were again completely victorious, and inflicted several defeats upon the Burgundians at Granson in Vaud and at Murten (Morat) in Freiburg (1476), and at Nancy (1477), where Charles was slain. Freiburg and Solothurn were admitted into the confederation (1481), and defensive alliances were concluded with neighbouring states. Their prosperity rose to such a height that all the adjacent courts, even Austria, sought their friendship and alliance.

The last war with Austria broke out in 1498. The Swiss had a severe struggle, but, victors in six sanguinary battles, they were, by the Peace of Basle (1499), practically separated from the empire, a separation to which formal and international sanction was given in 1648. After this war they had no longer any enemy to fear, and their future wars were waged on behalf of foreign powers.

In 1501 Basle and Schaffhausen, and in 1513 Appenzell (which had long been an ally), were admitted into full federation. The number of cantons was thus brought up to thirteen, at which it remained till 1798. The town and the abbot of St. Gall and the town of Bienne had

seats and votes in the Diet without being in full federation; and there were besides six allies of the confederation not enjoying these privileges—the Grisons, Valais, Geneva, Neuchâtel, Mühlhausen, and the bishopric of Basle. In 1516 France gave up to Switzerland the whole of the present canton of Ticino.

The Reformation. In 1518 the Reformation began to make its way into Switzerland, chiefly through the efforts of Zwingli at Zürich. Zwingli fell at Kappel (1531), but his work was carried on by Calvin at Geneva. The effect of the Reformation and Counter-Reformation for long was to divide Switzerland into separate camps. Aristocracy and democracy, Protestantism and Catholicism, struggled for the superiority. Internal dissensions, religious and political, continued for nearly two hundred years. The last time the two great parties met in arms was at Willmergen in 1712, when victory declared itself for the Protestants. Formal recognition of Swiss independence of the Empire was given by the Treaty of Westphalia (1648), and from then till 1798 French influence predominated.

Democratic Movement. At the end of the eighteenth century the ferment of the French Revolution spread to Switzerland; and in 1798 the ancient confederation was replaced by the Helvetic Republic, which lasted four years. In 1803 Napoleon I. organised a new confederation, composed of nineteen cantons, by the addition of Aargau, Grisons, St. Gall, Ticino, Thurgau, and Pays de Vaud. In 1815, by the compact of Zürich, Neuchâtel, Geneva and Valais were admitted into the confederacy, and the number of cantons was thus brought up to twenty-two. This confederacy was acknowledged by the Congress of Vienna (1815), which proclaimed the perpetual neutrality of Switzerland and the inviolability of its soil. In 1847 a separatist league of seven Catholic cantons (the Sonderbund) had to be dissolved by force of arms, and next year a new Federal Constitution was introduced. During the commotions of 1848 Neuchâtel set aside its monarchial form of government and adopted a republican one, and in 1857 it was put upon the same footing with the other cantons.

European War. On the outbreak of the European War the chief aim of the nation was to preserve the independence and integrity of the country, but the Government had to face a difficult situation. The mobilisation of the army necessitated excessive expenditure, and the maintenance of neutrality imposed heavy burdens. War loans had to be floated, and special war taxes were authorised by a referendum. Public services were put to a severe test, and steps had to be taken to avert an economic crisis.

As the war continued, Switzerland experienced considerable difficulty in maintaining her strict neutrality, as German intrigues and influence increased in the country and gained the sympathies of the German Swiss obliged to work and carry on trade with opposing belligerents, the Government frequently found itself in a very difficult position. Thus it had to reject a petition from the cantons of Geneva, Vaud, and Neuchâtel urging the Federal Council to protest against the deportation of Belgians and French by the Germans.

Suffering as the country did from economic difficulties, it concluded an Economic Convention with Germany in Sept., 1916, by the terms of which Switzerland promised to supply Germany with cattle and cheese, and Germany to supply Switzerland with coal and coke. Switzerland also promised to stop exportation to the Entente Powers of ammunition and explosives in the making of which German material had been used.

In 1917 Switzerland suffered severely from a scarcity of food supplies, and the Government protested against the new German submarine warfare, but it did not sever its relations with Germany. Rumours also spread that Germany was about to invade the country, and the Federal Government at once took measures to place the country on her guard. Generally speaking, the sympathies of the Swiss nation during the European War were divided. The German-Swiss, constituting the majority, were on the side of Germany, whilst French and Italian cantons were in favour of the Entente Powers.

As for the Swiss Government, it pursued a policy based on the fear of Germany and inspired by a belief in and expectation of Germany's final victory. In consequence of her central position, the country was, on the other hand, able to render considerable humanitarian services to all belligerents, facilitating the exchange of disabled prisoners. Where it was a question of charity, Switzerland, French and German, was united.

During the war the country also became a convenient meeting-place for peace conferences. Thus a Socialist conference was held at Zimmerwald on 15th Sept., 1915, when a manifesto was issued to the European prole-

tariat, and on 17th May, 1917, another Socialist conference took place at Kienthal.

The charitable and humanitarian work done by Switzerland—particularly by the Swiss Red Cross and by the International Red Cross at Geneva—was invaluable. Switzerland became the great clearing-house for humanitarian negotiations between the belligerent countries. Many important international conferences have been held in Switzerland, notably at Lausanne (Allies and Turkey) in 1923, and at Locarno (q.v.) in 1925. Geneva is the headquarters of the League of Nations.

Literature. Switzerland, on account of the linguistic diversity of the country, has no national literature. The works of the eminent Swiss authors belong either to French or to German literature.

Before the Reformation Swiss authors wrote either in Latin or in German. Ballads, lieder, war songs, and historical chronicles have come down to us. Berthold Steinmar and Hans Hadlaub (1250-1325) are the most prominent among the Swiss minnesingers; Halbsutter wrote the *Song of Sempach*, whilst in the fifteenth century appeared the *White Book of Sarnen* and the *Tellenlied*. The Swiss reformers and humanists wrote either in Latin or in German. The Bernese Nicholas Manuel (1484-1530), the most remarkable poet of the Swiss Reformation, criticised in German the Pope and the Catholic clergy.

The sixteenth century produced the historians Jean Stumpf (1500-76) and Ægidius Tschudi (1505-72); the philologist and mathematician Sebastian Münster (1489-1552); and the bibliographer and zoologist Conrad Gesner (1516-65), author of *Historia Animalium*.

During the eighteenth century a Swiss school of literature arose in German Switzerland with J. J. Bodmer (1698-1783) and J. J. Breitinger. They criticised the views of Gottsched, broke with the traditional French classicism, and recommended to study of the English poets, as nearer akin to the national Swiss genius. The Bernese poet Albert von Haller (1708-77) preached a return to nature, whilst the philosopher Iselin (1728-83) was a precursor of Herder. During this century Switzerland also produced the great mathematicians Euler (1746-1827) and the Bernoullis, and the educational reformer Pestalozzi.

Among prominent German-Swiss authors of the nineteenth century are: Albert Bitzius (1797-1854), known under the pseudonym of Jeremias Gotthelf, who described the rustic life of his native land; Gottfried Keller (1819-90), novelist and poet; and Conrad Ferdinand Meyer (1825-98), who chose ancient Rome, the Middle Ages, and the Renaissance as subjects for his artistic compositions. Of more recent German-Swiss writers may be mentioned Ernest Zahn and Carl Spitteler (1845).

The French language has been employed in Switzerland since the thirteenth century, but it is only since the Reformation that important literary works have been produced in French Switzerland. The first writers were preachers and theologians, such as Farel and Viret, the historian Bonivard, and the poet Blaise Hory. After the revocation of the Edict of Nantes, a number of cultured Frenchmen came to Switzerland, and Louis Bourguet (1678-1754) founded the *Mercure Suisse* (1732), to which Ph. C. Bridel (1757-1845) contributed important articles. The latter also wrote *Poésies Helvétiennes*.

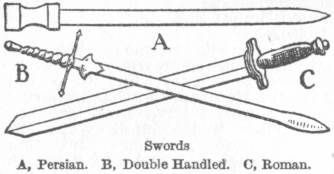
In 1796 the brothers Pictet founded the *Bibliothèque Britannique*, which was succeeded by the *Bibliothèque Universelle*. Rudolf Töpffer (1799-1846), author of *Nouvelles Genévoises* and *Voyages en Zigzag*, founded the *Courier de Genève* in 1841. The *Journal de Genève* appeared in 1826, and the *Revue Suisse* in 1838. To the same period belong the philosopher Bonstetten; the national poet A. Richard (1801-81); Petit-Senn (1792-1870); the moralist Henri Amiel (1821-81); the literary historian Alexandre Vinet (1797-1847); the poet Juste Olivier (1807-76); and Eugène Rambert (1830-86), author of *Alpes Suisses*.

Among more recent French-Swiss authors are: Edouard Rod (1857-1910); Isabelle Kaiser; Philippe Monnier; and J. V. Widmann (1842-1911), poet, dramatist, and novelist, author of *La Patricienne* and *Esquisses Italiennes*, also the poets Tazan, Dalcroze, and Cougnard. —Cf. V. Rossel and H. E. Jenny, *Histoire de la littérature Suisse*.

BIBLIOGRAPHY: F. C. Cameron, *Switzerland* (Nations' Histories); Hug and Stead, *Switzerland*; Grenfell Baker, *The Model Republic*; Leslie Stephen, *The Playground of Europe*; R. C. Brooks, *Government and Politics of Switzerland*; V. M. Crawford, *Switzerland of To-Day*.

SWORD. A weapon of such early and, till comparatively modern times, such general use as to supply a synonym for strife. It consists of two parts: the hilt or handle, and

the blade, which may be either curved or straight, with or without a stabbing point, and having one or both its edges sharp. It is not easy clearly to differentiate the dagger from the sword, very short-bladed swords being sometimes exceeded in length by long daggers; but the



Swords

A, Persian. B, Double Handled. C, Roman.

dagger is the weapon of assassination rather than of a legitimate and open fight. Even the very earliest swords were of metal, the term being hardly applicable to the flattened clubs of wood or stone in use in prehistoric times.

The first swords were of copper, their form probably imitated from the Neolithic daggers made of flint or horn. Bronze replaced copper about 2000 B.C., iron gradually coming into use several centuries later. During the bronze period the leaf-shaped blade was common; its length was from 16 to 30 inches. Specimens have been found in Ireland, also at Mycenæ.

The Roman sword was straight and double-edged, the blade some 3 feet long; the Greeks, till about 400 B.C., employed a shorter and lighter weapon. The iron swords of the vikings were long, straight, broad-bladed, and of heavy weight, with hilts often richly decorated.

Very little science was at first employed in the use of the sword, the overhand stab being common even with those of considerable length. Attack was long the only end in view, simultaneous defence by skilful use of the blade being a modern innovation. Cutting and hacking with the blade-edges are more simple, and consequently more general, than thrusting with the point; it was by attention to this latter method that the Roman invaders of Britain often routed the unsophisticated natives.

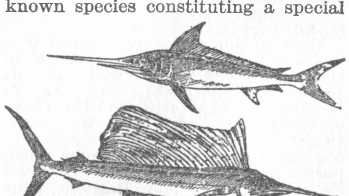
Some defence against the opponent's weapon was, however, afforded by the cross-guard or *quillon*, which, at first straight, later assumed a form in which the ends curved towards the blade. It may be noted that in the "unchanging East" the Asiatic never thrusts, but strikes with the curved scimitar, the edge of which is on the convex of the blade. The cutting power of the scimitar, though great, is counter-balanced by its feeble power of defence.

Damascus was long famous for superior blades; Khorāsān still produces weapons of fine quality. Toledo blades, with those produced by the Ferrara family of North Italy—Andrea especially (born 1555)—enjoyed a great repute.

In later times the sabre, a heavy sword worn by dragoons, was used for both the cut and thrust. From the rapier developed the light, supple duelling-sword, of which the point alone came into play. The cutlass, broad and straight-edged, with a 3-foot blade, was long the weapon of the British seaman, used in boarding ships. The Highland claymore ("great sword"), with a blade some 40 inches long, had usually a globular pommel. The broadsword was a cutting weapon, while of the old two-handed sword some specimens survive. Basket-hilted swords had highly decorated hilts.

In late years, in both France and Britain, there have been frequent changes in the shape and general style of army swords; but in the European War these once so familiar weapons played but a small part. Officers led their men "over the top" revolver in hand; while it was generally found more useful to arm even cavalry with the rifle.—BIBLIOGRAPHY: Sir R. Burton's unfinished *Book of the Sword* (1884); A. Hutton, *Sword and the Centuries* (1901).

SWORD-FISH. A spiny-finned fish allied to the mackerel and represented by the common sword-fish (*Xiphias gladius*), the single known species constituting a special



Sword-fishes

family (Xiphiidæ). It occurs in the Mediterranean Sea and Atlantic Ocean, but may also be occasionally found round the coasts of Britain. It attains a length of from 12 to 15 or even 20 feet, the elongated upper jaw, or sword, forming three-tenths of its length.

Its body is covered with minute scales. Its colour is a bluish-black above, and silvery white on the under parts. The ventral fins are wanting. It is fished for by the Neapolitan and Sicilian fishermen with the harpoon. Its flesh is very palatable and nutritious. It attacks other fishes, and often inflicts fatal wounds with its powerful weapon; and there are frequent instances in which the timbers of ships have been found to be perforated through and through by the sword-like jaw, which has been left sticking in the wood.

SYB'ARIS. An ancient Greek city of Lower Italy, on the Gulf of Tarentum, founded by Achæans and Trœzenians about 720 B.C. It rapidly rose to an extraordinary degree of prosperity, and the inhabitants were in ancient times proverbial for their luxury and voluptuousness. It was totally destroyed by the Crotonians, who turned the waters of the River Crathis against it (510 B.C.). In 1879 and 1887 excavations were undertaken by the Italian Government, and two necropolises were found.

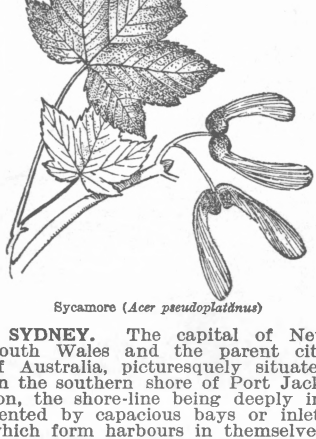
SYBEL (zē'bl), **Heinrich von.** German historian, born 1817, died 1895. He studied at Berlin under Ranke, and became successively professor of history at Bonn, Marburg, Munich, and Bonn again. In 1875 he became director of the Prussian State archives at Berlin, and member of the Academy of Sciences. He is best known in England by his *History of the French Revolution*.

SYCAMORE. A European species of maple (*Acer pseudoplatănus*), a large and well-known timber tree (called *plane* in Scotland); also, in the western parts of the United States, a name for the occidental plane or buttonwood. *See* MAPLE; PLANE TREE.

SYCAMORE. A tree of the genus Ficus, the *F. Sycomŏrus*, or sycamore of Scripture, a kind of fig tree. It is very common in Palestine, Arabia, and Egypt, growing thick and to a great height, and, though the grain is coarse, much used in building, and very durable. Its wide-spreading branches afford a grateful shade in those hot climates, and its fruit, which is produced in clusters upon the trunk and the old limbs, is sweet and delicate. The name was at one time frequently written *sycomore*.

SYCOSIS. A chronic pustular eruption affecting the follicles of the hairs of the beard and moustache. The disease occurs in adult males, most usually among those who are shaved by barbers. Once the disease is established it is very resistant to treatment, and may persist for years.

SYDENHAM, Thomas. English physician, born 1624, died 1689. He took the degree of Bachelor of Medicine at Oxford in 1648, commenced practice as a physician at Westminster, and applied himself with unusual keenness to observation of the phenomena of disease. Febrile disorders and the gout attracted his especial notice. The Sydenham Society, which owes its name to him, has published an English translation of his works, which were all written in Latin.



Sycamore (*Acer pseudoplatănus*)

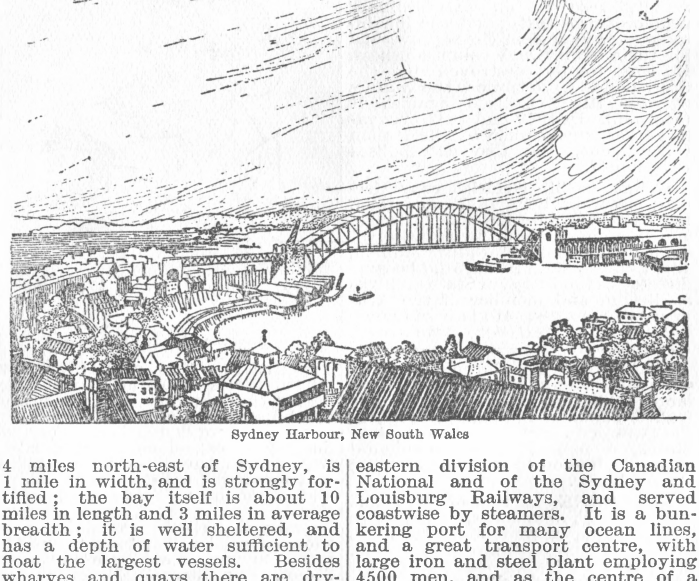
SYDNEY. The capital of New South Wales and the parent city of Australia, picturesquely situated on the southern shore of Port Jackson, the shore-line being deeply indented by capacious bays or inlets which form harbours in themselves, and are lined with wharves, quays, and warehouses. Some of the older streets are narrow and crooked, bearing a striking resemblance to those of an English town; but the more modern streets, such as George Street, Pitt Street, Market Street, King Street, and Hunter Street, rank high in order of architectural merit.

The tramway system is extended to all parts of the suburbs, and water communication between the city and its transmarine suburbs, Balmain, North Sydney, Greenwich, etc., is maintained by steam-ferries. Among the most important public buildings are: the Government offices; the town hall, with a tower 156 feet high, and a great hall with a huge organ; state Governor's house; the university, a Gothic

building with a frontage of nearly 400 feet, situated in a fine park; St. Andrew's (Episcopal) Cathedral; St. Mary's (Roman Catholic) Cathedral.

The Botanical Gardens are the finest in the colonies (38 acres). Moore Park, 600 acres; the Centennial Park, designed to commemorate the colony's centenary (1888), 768 acres; and the racecourse, 202 acres, are other open spaces.

The entrance from the Pacific Ocean to Port Jackson, about



Sydney Harbour, New South Wales

4 miles north-east of Sydney, is 1 mile in width, and is strongly fortified; the bay itself is about 10 miles in length and 3 miles in average breadth; it is well sheltered, and has a depth of water sufficient to float the largest vessels. Besides wharves and quays there are dry-docks and other accommodation for shipping, and the trade of the port in very large.

The principal exports are wool, tallow, hides, preserved meat, tin, copper, etc.; the imports, grain, tea, coffee, sugar, wine and spirits, ironware and machinery, cotton and woollen goods, wearing apparel, furniture, etc. Sydney was founded in 1788, and was named in honour of Viscount Sydney, the Colonial Secretary. It was incorporated in 1842. The discovery of gold in the colony (1851) gave an immense impetus to its progress. Since 1929 Auburn, Bankstown, Granville, Lidcombe, and Parramatta have formed part of the city. The famous bridge, opened 19th March, 1932, provides direct rail and other communication between the city and the northern shore of the harbour, avoiding the previous long detour. Sydney has a broadcasting station (31·28 m., 20 kw.). Pop. (1931, including suburbs), 1,256,230.

SYDNEY. A city of Nova Scotia, Canada, in Cape Breton county, on Sydney Harbour, the terminus of the eastern division of the Canadian National and of the Sydney and Louisburg Railways, and served coastwise by steamers. It is a bunkering port for many ocean lines, and a great transport centre, with large iron and steel plant employing 4500 men, and as the centre of a great coal-field it has other considerable manufacturing industries. Pop. (1931), 23,089.

SYDNEY MINES. A town of Nova Scotia, Canada, in Cape Breton county, on Sydney Harbour; served by the National and Coal Company's Railways. Over 4300 men are employed in the local collieries and brick-yards, the coal output being roughly 900,000 tons per annum. The Sydney coal-field lies along the seaboard, and embraces 1125 sq. miles. The coal is bituminous and

resembles that of Northern England. Pop. 8327.

SY'ENITE. A rock composed of hornblende and orthoclase felspar with occasionally a little quartz. It was named from Aswan, in Upper Egypt, the ancient Syene; but the rock of Aswan is a true granite with abundant quartz. Syenite is a comparatively rare rock, resembling granite. Biotite or even pyroxene occasionally takes the place of hornblende, and the syenites of Southern Norway are rich in nepheline (elæolite). Granite which contains hornblende is called *syenitic granite*, and fine-grained syenite, containing large crystals of felspar, is called *syenite-porphyry*.

SYKE. A market town of Germany, in the Prussian province of Hanover, the junction for Hoya on the Münster-Bremen (via Osnabruck) line of the State railways.[1] Pop. 2000. Hoya lies on the Weser, and is a junction for Eystrup and Bucken. Pop. 2500.

SYL'LABUS ERRORUM. A document issued by Pope Pius IX., 8th Dec., 1864, which condemned eighty current doctrines of the age as heresies. The syllabus reasserts all the claims of the mediæval papacy. It provoked conflicts between the Papal and the civil power in Prussia, Austria, and Brazil.

SYLLOGISM AND FALLACIES. **Syllogism,** in logic (Gr. *syn*, together, and *logos*, thought), the joining together in thought of two propositions. It is defined as "the act of thought by which from two given propositions we proceed to a third proposition, the truth of which necessarily follows from the truth of these given propositions." The two first propositions are called *premises*, and the last the *conclusion*. Thus *Plants have not the power of locomotion*; *An oak is a plant*; therefore *An oak has not the power of locomotion*.

These propositions are denominated the *major premise*, the *minor premise*, and the *conclusion*. The three propositions of a syllogism are made up of three ideas or terms, and these terms are called the *major*, the *minor*, and the *middle*. The subject of the conclusion is called the *minor term* (oak); its predicate is the *major term* (the power of locomotion); and the middle term is that which shows the connection between the major and minor term in the conclusion, or it is that with which the major and minor terms are respectively compared (*plants*).

The rules of the syllogism are founded upon the Laws of Thought, namely, (1) The Law of Identity: *Whatever is, is.* (2) The Law of Contradiction: *Nothing can both be and not be.* (3) The Law of the Excluded Middle: *Everything must either be or not be.* These rules, which serve to inform us under what circumstances we can infer one proposition from two other propositions, are eight in number:

1. In a syllogism there must be three, and *only* three, terms.
2. Every syllogism must contain three, and *only* three, propositions.
3. The middle term must be distributed once at least, and must not be ambiguous.
4. Neither the minor term nor the major term must be distributed in the conclusion, if it is not distributed in one of the premises.
5. Nothing can be inferred from negative premises.
6. If one of the premises be negative, the conclusion must be negative; and also, *one* of the premises must be negative, if we are to prove a negative conclusion.
7. No conclusion can be drawn from two particular premises.
8. A conclusion must be particular, if one of the premises be particular.

Syllogisms are usually divided into *categorical*, *hypothetical*, and *disjunctive*. They differ in *figure* and in *mood*. The figure depends on the order of the terms in the premises, whilst the distinction of moods depends on the *quantity* or *quality* of the propositions, which are either universal, particular, affirmative, or negative in all possible combinations.

The quantity and quality of propositions in logic are marked by arbitrary symbols, as A, E, I, O. Every assertion may be reduced to one of four forms: the universal affirmative, denoted by A; the universal negative, E; the particular affirmative, I; and the particular negative, O. Examples of these are: (A) *All men are liable to err*; (E) *No man is the exact counterpart of another*; (I) *Some men are wise*; (O) *Some men are not wise.*

As each of the three propositions of a syllogism may have any of the four forms A, E, I, O, there are 4^3, or 64 moods, but only 19 of these are valid, the rest failing in some respect to comply with the rules. About six centuries ago, mnemonic hexameter verses were invented to aid in remembering the valid moods. The verses are as follows:

Barbara, Celarent, Darii, Ferioque, prioris;
Cesare, Camestres, Festino, Baroko, secundæ;
Tertia, *Darapti, Disamis, Datisi, Felapton, Bokardo, Ferison*, habet; Quarta insuper addit
Bramantip, Camenes, Dimaris, Fesapo, Fresison.

[1] See *Systems, Railway* (Paragraphs 8 and 13).

Each name contains three vowels, indicating propositions forming a valid mood. Thus, *Camectres* signifies the mood having *A* for the major premise, *E* for the minor premise, and *E* for the conclusion.

Fallacies. A fallacy is the incorrect performance of the process of reasoning, leading to a wrong conclusion. It is thus a violation of a logical law. It is usual to classify fallacies into two groups: (1) *logical fallacies*, occurring in the mere form of the statement, and for the discovery of which no knowledge of the subject-matter is necessary; (2) *material fallacies*, concerned with the subject-matter.

Logical fallacies violate the syllogistic rules. Examples of logical fallacies are: (1) The *Quaternio Terminorum*, or fallacy of four terms, violating the rule that a syllogism should have three, and only three, terms. (2) The fallacy of the *undistributed middle*, violating the syllogistic law that the middle term should be distributed once at least. (3) The fallacy of *illicit process*, violating the rule that no term must be distributed in the conclusion which was not distributed in one of the premises. (4) The fallacy of *negative premises*, violating the law that at least one of the premises must be affirmative. To the logical fallacies also belong the following: *equivocation*, *amphibology* (an ambiguous grammatical structure producing misconception), *composition*, *division*, *accent*, and *figure of speech*.

Among material fallacies the most important are: the *ignoratio elenchi*, or *irrelevant conclusion* (the fallacy of irrelevant reasoning, and arguing to the wrong point, the argument, sound in itself, being assumed to establish a conclusion which is not that actually proved); the *petitio principii*, or begging the question, a fallacy which consists in taking the conclusion itself as one of the premises; and the *fallacy of many questions*, which combines two or three questions into one in such a manner that no true answer, either *yes* or *no*, can be given.—BIBLIOGRAPHY: A. Sidgwick, *Fallacies*; R. Adamson, *Short History of Logic*; J. S. Mill, *System of Logic*.

SYLPHS. The elemental spirits of the air in the system of Paracelsus. The sylphs, like the other elemental spirits, form the link between immaterial and material beings. They have many human characteristics, are male and female, and are mortal, but have no soul, and consequently suffer annihilation after death.

SYLT. An island of Germany in the North Sea, off the coast of Schleswig-Holstein; area, 40 sq. miles. It consists largely of sand-dune country and marsh land. The inhabitants are Frisians and (in the north) Danes, and are largely engaged in fishing. The island is also a sea-bathing centre. Pop. 5000.

SYL'VESTER I. Bishop of Rome (314-335); he was represented at the Council of Nice, and is said to have held a council at Rome to condemn the errors of Arius and others. The story of his having baptised Constantine and received Rome and its temporalities as a donation is pure fiction. He is honoured as a saint.

SYLVESTER II., Pope. He was born of an obscure family in Auvergne named Gerbert, and at an early age entered the monastery of St. Gerard, in Aurillac. He travelled into Spain to hear the Arabian doctors, and became so distinguished that he was appointed by Hugh Capet preceptor to his son Robert. Otho III., emperor, who had also been his pupil, conferred upon him the archbishopric of Ravenna in 998; and on the death of Gregory V., in 999, procured his election to the papacy.

He maintained the power of the Church with a high hand, was a great promoter of learning, and composed a number of works, particularly on arithmetic and geometry. He died in 1003. Among the vulgar he had the reputation of being a magician.

SYLVESTER, James Joseph. English mathematician, born in London of Jewish parents in 1814, died in 1897. He was second wrangler in the mathematical tripos of 1837, and in the course of his career held many professorships in England and the United States, finally succeeding Henry Smith, in 1883, as Savilian professor of geometry at Oxford. He ranks hardly behind Cayley among British pure mathematicians of the Victorian period. His researches related chiefly to finite, as contrasted with infinitesimal analysis, and he made brilliant and far-reaching discoveries in such theories as invariants and the partition of numbers. The Royal Society, of which he had been a Fellow from 1839, awarded him the Royal medal in 1861, and the Copley medal in 1880.

SYLVESTER, Joshua. English poet, born in 1563; he was a member of the company of merchant adventurers at Stade, Holland. He is known chiefly as the translator into English of the *Divine Weeks and Works* of the French Huguenot poet Du Bartas, a translation to which

Milton owed something when writing *Paradise Lost*. Sylvester died at Middelburg, Holland, in 1618.

SYLVIA. A genus of perching birds, type of the sub-family Sylviinæ, or warblers, of the thrush family (Turdidæ). Common British examples are: whitethroat (*S. cinerea*), blackcap (*S. atricapilla*), and garden warbler (*S. hortensis*).

SYLVICULTURE, or SILVICULTURE. Literally the culture of woods; it deals with the growing and tending of forests until the products are ready for utilisation. Forests are mainly grown for timber, but where monetary returns are of small importance other considerations, such as natural beauty, influence on climate, shelter, and the like, play an important part.

Climatology includes the atmosphere, climate, and soil of an area. Most trees thrive best in a moist atmosphere, provided the air is not stagnant. The demand on light varies considerably. There are the light-demanders (e.g. oak and Scots pine), insisting on plenty of light, and the shade-bearers (e.g. beech and spruce), that will flourish under varying degrees of shade. This question of light and shade is of very great importance in practical sylviculture.

All trees like a fresh soil, where the natural drainage is good. Some species, such as alder and willow, do well in moist situations, while most of the conifers prefer drier ground. Wind is a very powerful factor in the successful growth of trees. Species with deep tap-roots (e.g. oak and larch) suffer little from wind, while shallow-rooted trees (e.g. spruces) may be easily uprooted. Care must also be taken when felling an area not to cut the trees in the direction of the prevailing wind. To avoid giving the wind an inlet, begin operations at the other side of the wood.

Woods are either *pure*, i.e. of one species, or *mixed*, where more than one species is grown. Some species (e.g. beech, spruce, Douglas fir, etc.) can thrive in pure woods owing to their shade-bearing qualities. Where woods are to be mixed, the best method in practice is that of growing the different trees in larger or smaller groups according as the soil suits them.

The first operation in planting is to fence against ground game. Draining may be necessary, and the surface vegetation, if of a coarse nature, should be cut or burnt. Woods may be established either *artificially* by sowing and planting, or naturally by *natural regeneration*. The commonest method is by planting, and the plants must be strong, not too old, and with plenty of fibrous roots.

Trees may be planted at any time from October to April, provided the weather conditions are suitable; and the young plants, if coming from a distance, should be carefully packed. There are two main methods of planting: (1) *notching*, or placing the plants under raised pieces of turf; and (2) putting the young trees in small pits, the latter being a more expensive but a better system. Natural regeneration of woods is their establishment by the fall of seed from adjacent mature woods, and though such a method may take several years, the resulting timber is often the finest.

During the early life of a wood, gaps caused by failures have to be filled up, and the young plantations must be kept clean. Proper thinning of young woods is an essential operation of great difficulty. Thinnings should be light and frequent rather than seldom and heavy, and towards the end of a wood's rotation thinnings may be heavier, so as to allow the best trees that remain full scope for development.

Rotations differ for the various species, and may vary from sixty to ninety years in the case of conifers, to nearly two hundred years for oak. No hard or fast rules can be laid down, however, as the commercial rotation will depend much on the natural factors and the market conditions. The trained forester knows from experience when a forest is ripe for the axe, and realises that delay in its utilisation may mean deterioration of the crop, and economic loss.

SYLVINE. Mineral potassium chloride, crystallising like rock-salt in the cubic system, and occurring in beds associated with it. The mixed material is sold as an agricultural fertiliser under the trade name of *sylvinite*, which contains about 25 per cent of potassium chloride. Sylvinite is the chief product of the potash-salt mines in Alsace. Beds of pure sylvine are unknown on a commercial scale.

SYMBIO'SIS. The intimate organic association of two kinds of organisms for mutual benefit. A lichen consists of an alga connected with a fungus; and certain nitrogen-fixing bacteria inhabit nodules on the roots of leguminous plants.

SYMBOL. A sign by which one knows or infers a thing; an *emblem*.

It is generally a definite visible figure intended to represent or stand for something else, as in the case of the common *astronomical symbols*, which are signs conveniently representing astronomical objects, phases of the moon, etc., and astronomical terms. Some of these symbols are so ancient that we can find no satisfactory account of their origin.

The symbols for the chief heavenly bodies are as follows: Sun ☉, Mercury ☿, Venus ♀, Earth ♁ and ⊕, Moon ☾, Mars ♂, Jupiter ♃, Saturn ♄, Uranus ♅, Neptune ♆, Comet ☄, Star ✳. The asteroids are represented by a circle with a number, thus, (64). *Lunar phases*: ● Moon in conjunction, or *new*; ☽ Moon in eastern quadrature, or *first quarter*; ○ Moon in opposition, or *full*; ☾ Moon in western quadrature, or *last quarter*. *See* ECLIPTIC.

Chemical symbols are merely the first letters of the names of the chemical elements; or, when the names of two or more elements begin with the same letter, two letters are used as the symbol, one of which is always the first letter of the name of the element. Generally speaking, the letters comprising the symbol are taken from the English name of the element; but in some instances, especially in the cases of metals which have been long known, the symbols are derived from the Latin names, as Fe (Lat. *ferrum*) for iron. *See* CHEMISTRY.

Mathematical symbols are letters or characters used to denote numbers, functions, operations, and relations. Sometimes a letter is used for a definite number, as e, or π; more usually, however, the use of a letter for a number indicates that the number is not restricted to have one special value. On the other hand, any one letter which occurs in an investigation must represent the same number throughout. Similarly, when a letter is used as a symbol for a *function*, it may stand either for one special function, or for any function at all.

The symbols Γ, Π, J, for example, are invariably understood to stand for the gamma, pi, and first Bessel Function respectively. Symbols other than letters, such as $+$, $-$, $\times$, $\div$, $\surd$, $\therefore$, $=$, $>$, $<$, are also in general use as a kind of shorthand for common words or phrases.

SYMBOLISM. The representation of a thing, person, or idea by a conventional sign which—invested with an inner meaning—recalls the idea, person, or thing in consequence of a process of analogy. The use of objects as sensuous emblems of spiritual acts has been widespread in religion, pagan as well as Christian.

The Old Testament is full of symbolism, and the early Christians, in consequence perhaps of persecutions, and anxiety not to attract attention, introduced symbols into their religion. Thus Christ is represented as the lamb or by the letters alpha and omega. Symbolism is also important in primitive and Christian art.—Cf. R. P. Knight, *The Symbolical Language of Ancient Art and Mythology*.

SYMBOLISTS. The name applied to a school of writers which sprang up in France in the latter half of the nineteenth century. The Symbolists used in poetry the details of the phenomenal world exclusively as symbols of that inner and spiritual reality which it was their aim to project in art. Concerned with general truth instead of actualities, they chose dreams and visions as their subjects, and suggested instead of naming.

The Symbolist movement, which profoundly influenced French literature, was a reaction against the realism of the Parnassians (q.v.). The most noteworthy members of the Symbolist school were Paul Verlaine, Stéphane Mallarmé, Henri de Régnier, and the Belgian poet Maeterlinck.—Cf. A. Symons, *The Symbolist Movement in Literature*.

SYM'MACHUS, Quintus Aurelius. Roman writer and orator, who flourished about A.D. 340-402; held important public offices under Theodosius the Great, and was a zealous champion of the pagan religion. We possess ten books of letters by him, which are of importance for the history of the time, and the fragments of nine orations.

SY'MONDS, John Addington. English man of letters, born 1840, died 1893. He was educated at Harrow and at Balliol College, Oxford. His great work is the *Renaissance in Italy* (1875-86). Among his other works are: *Study of Dante*; *Studies of the Greek Poets*; *Sketches in Italy and Greece*; *Sketches and Studies in Italy*; translations of the *Sonnets* of Michelangelo and Campanella; *Animi Figura*, a collection of sonnets; *Vagabunduli Libellus*; *Wine, Women, and Song*; *Essays*; *Life of Michelangelo*.

SYMPETALÆ. The gamopetalous section of dicotyledonous plants in Engler's classification, corresponding to the Corolliflorœ of Bentham and Hooker.

SYM'PHONY. A symphony is the most important form of instrumental composition, and might be described as a sonata for full orchestra, the symphony being in most cases of greater dimensions and altogether broader in its scope, in consonance with the larger musical means employed. As an instrumental form it dates from the latter half of the eighteenth century, the first representative examples coming from the pen of Haydn, who wrote in all a hundred and twenty-five symphonies.

Mozart wrote forty-one symphonies, of which the *Jupiter* and those perfect examples in E flat and in G minor are the most famous. With the development of the art of composition, the labour involved in writing works of large dimensions became steadily more exacting, and this accounts for the fact that Beethoven wrote only nine symphonies.

Though numerically this was a small output, the works themselves are of outstanding importance, and mark a very great advance both as regards their form and their range of expression. While all of them are in the standard orchestral repertoire, the *Eroica* (No. 3); the fifth, in C minor; the *Pastoral* (No. 6); the seventh; and the ninth are the most frequently played. The *C minor* may fairly be regarded as the most universally popular symphony ever written. The ninth symphony is the longest and perhaps the greatest of all, embodying for all true Beethoven lovers the finest expression of his "third period."

Another notable writer of symphonies was Schubert, whose *Unfinished Symphony* takes rank in popular favour with the fifth of Beethoven, and whose great symphony in C is almost equally popular. Schumann wrote four fine examples. Brahms also wrote four symphonies of great power and beauty, which are regarded as in the line of direct descent from those of Beethoven.

The Tchaikovsky symphonies are less truly symphonic in their texture than the classical examples, but make a quick and wide appeal by virtue of their melodiousness, their almost sensational dramatic qualities, and their gorgeously coloured orchestration.

A symphony generally consists of four movements, of which the first is almost invariably in sonata-form (q.v.), and the second of a slower and song-like character. The third movement was always a minuet and trio in the earlier examples, but later a scherzo (q.v.), while the last movement is generally fashioned on the plan of the first movement, though more freedom of form and of structure is frequently found. Thus the last movement of Brahms' fourth symphony is, broadly speaking, a series of variations on a ground bass.

An exceptional form of last movement is found in Tchaikovsky's *Symphonie Pathétique*, which closes with a poignantly pessimistic lament. A shorter or longer introduction frequently precedes some of the movements, especially the first and last; and in some more recent examples of the symphony a "motto" theme appears in the first movement, and reappears in some or all of the remaining movements.

A **symphonic poem** may be defined as a symphony in one continuous movement, and free in form. Both symphonies and symphonic poems should be consistently built up by the development and interweaving of a limited number of principal themes; and the power to distinguish himself in writing in either form proves a composer to be an inspired thinker and an expert craftsman. Symphonies are rarely written nowadays. A modern example is the *Colour Symphony* of Arthur Bliss (1922).

SYMPIESOM'ETER. A kind of barometer in which the weight of the air is indicated by the compression of gas in a tube, the lower part of the tube being filled with some oily fluid and the gas occupying the upper portion. By an auxiliary contrivance, allowance can be made for the temperature at the time of observation. The instrument is sensitive, but not very accurate. It was at one time a good deal used on board ship, but has been superseded by the aneroid barometer.

SYMPODIUM. In botany, a false main axis, built up from the basal parts of branches of successively higher order, as a twig of the lime, or the rhizome of Iris. *See* BRANCHING.

SYNAGOGUE (from Gr. *synagogē*, an assembly). The recognised place of public worship among the Jews. Its origin, it is supposed, belongs most probably to the date of the Babylonian captivity in the abeyance of temple worship. The synagogues were so constructed that the worshippers, as they entered and as

they prayed, looked towards Jerusalem.

At the extreme east end was the holy ark, containing copies of the *Pentateuch*; in front of this was the raised platform for the reader or preacher. The men sat on one side of the synagogue and the women on the other, a partition 5 or 6 feet high dividing them. The chief seats, after which the scribes and Pharisees strove, were situated near the east end.

The constitution of the synagogue was congregational, not priestly, and the office-bearers were not hereditary, but were chosen by the congregation. A college of elders, presided over by one who was the ruler of the synagogue, managed the affairs of the synagogue, and possessed the power of excommunication.

The officiating minister was the chief reader of the prayers, the law, the prophets, etc. The modern synagogue differs little from the ancient. Instead of elders there is a committee of management; and the women are now provided with seats in a low latticed gallery.

The *Great Synagogue* was an assembly or council of 120 members said to have been founded and presided over by Ezra after the return from the captivity. Their duties are supposed to have been the remodelling of the religious life of the people, and the collecting and redacting of the sacred books of former times.—BIBLIOGRAPHY: article in *Jewish Encyclopædia*; J. Abrahams, *Jewish Life in the Middle Ages*.

SYNCHRONOUS MOTORS. Alternating-current motors are divisible into two classifications, synchronous or asynchronous, according to their speed of running. Asynchronous motors, of which the common induction motor (q.v.) is the principal type, run at a speed slightly lower than that corresponding to the periodicity of the alternating-current supply. On the other hand, those that work in step or phase with the supply current and have no slip are referred to as synchronous motors.

There are many distinctive types of such motors, but the main supply is usually applied to the stationary windings, instead of to the rotating part as in the common direct-current motor. By that arrangement good insulation is possible for the conductors carrying the high-pressure supply, and either no brush or collector gear is needed for the rotor, or whatever is necessary has only to deal with low-pressure currents.

The synchronous motor is simply an alternating-current generator reversed in its operation. The field coils are excited from a direct-current supply, or by rectified currents taken from the main alternating supply. When the rotating system is brought up to the speed corresponding to the periodicity of the supply, it continues to run under that condition until the motor is shut down.

The magnetic field set up in the primary or stationary coils is of a rotary character, and the conductors of the rotor create magnetic fields which "lock" with that of the stator coils, and thus the speed remains constant. Drastic actions, such as the very sudden imposition of heavy loads, may pull the rotor out of synchronism, in which case it will slow down and stop, and the restarting must be done while the motor is only lightly loaded.

The application of a series of short-circuited coils or *amortisseur* windings to the rotor prevents hunting about the synchronous speed, reduces the possibilities of shut-downs, and also serves to permit the starting of the machine as an induction motor.

Synchronous motors are very useful at points distant from the supply-station, as by over-exciting them the current of the system may be given a lead over the pressure, and thus correct the lagging actions caused by the use of induction motors or other appliances which have the same effect.

There are alternating-current motors of types corresponding with the series and shunt motors used on a direct-current supply. Any continuous-current series motor may be connected to a single-phase alternating-current supply system, and will run on it. This useful action, due to the simultaneous reversal of the armature and field currents, makes it possible to construct motors which are universal machines.

The repulsion motor corresponding to the shunt type of continuous-current working has no connection between the armature and field. The stationary windings induce currents in the rotor which act with the magnetic field caused by the fixed armature coils to set up a driving torque. On the rotor there is usually a commutator, with the brushes set opposite to each other and permanently short-circuited.

At the synchronous speed the motor runs practically sparkless, but at higher or lower values, which are possible, the commutation is not always satisfactory. Better running conditions are obtainable with motors of the two main types combined

than with the simple repulsion motor. In fact, the best characteristics of both types of motor are then obtained.

Synchronous motors of large size are used in motor generators for the transformation of high-tension alternating currents into low-pressure direct currents for a supply system. In that case the machine can be brought up to synchronous speed by running what is normally the generator as a motor off the direct-current supply, and, when the correct speed is reached, connecting up the alternating-current side to the input system.

This can only be done safely when the machine is running in proper phase relationship with the alternating-current supply, and instruments known as synchronisers are used for the purpose. The magnitude of the difference in phase between the supply and the machine is indicated by the intensity of illumination of an incandescent lamp.

SYNCOPATION. When modern music began at the end of the sixteenth century to establish itself upon the basis of folk-music, it received from this popular source two qualities in particular, harmony and accent. The latter was derived more directly from the folk-dances, and the regular recurrence of accent, which is a necessary feature of all dance music, was largely retained in the early works of the new instrumental composers. With the development of the craft of composition came the wish and the power to vary this regularity of the accents, and syncopation was introduced.

Syncopation is a disturbing of the regular metrical accent by singing or playing an accented note before it is due, thus anticipating the accent by half a beat or more. This was not a new feature in music, as a study of folk-tunes will quickly demonstrate, but its use as a conscious device in composition only came gradually into favour.

As a musical effect syncopation is very enjoyable when kept within bounds, but it is important that the music should be so contrived as to introduce the element of syncopation without destroying in the mind of the listeners the sense of the regular accents from which the syncopation is a departure.

Schumann, who habitually made very free use of the device in his compositions, was not always careful in this respect. An outstanding illustration is furnished by the last movement of his well-known piano concerto, where the second main theme is presented as a regularly syncopated form of triple time, but sounds to any listener who does not know the score as an ordinary example of duple time. Schumann's partiality for syncopation was satirised by an adverse French critic, who, when the great composer died, suggested that perhaps the cause of death was syncope.

SYNCOPE. The name given to a condition produced by a temporary suspension of respiration and of the circulation. On account of the inadequate supply of blood to the brain it results in faintness, or even a complete loss of consciousness, so that the patient collapses. It may occur in hæmorrhage or some forms of heart disease, and is liable to arise in all diseases or conditions which cause a very low blood-pressure. It is also seen as a result of mental shock or emotional disturbance, while in some people, with unstable vasomotor systems, a tendency to faint is always present.

SYNDIC. An officer entrusted with the affairs of a city or other community; also, a person appointed to act in some particular affair in which he has a common interest with his constituents, as when he is one among several creditors of the same debtor. The name has been given in different countries to various municipal officers. The mayors of towns in Italy are called syndics. In the University of Cambridge the term is applied to members of special committees appointed for specific duties.

SYNDICALISM (Fr. *syndicat*, a trade union). A policy involving ownership of the means of production in each trade by a union of the workers in that trade. Since the French Syndicalists adopted (about 1902) a policy of *direct* as opposed to *parliamentary* action, with the object of forcing the Government to accede to their wishes, the meaning of the word has become somewhat confused, and it is often applied to the advocates of political strikes rather than to those who wish to introduce a particular method of conducting industry. Syndicalism, in its original sense, has a considerable following among the workers of France, where State socialism has never made much headway.

It found a philosopher in M. Georges Sorel, whose *Réflexions sur la violence* is devoted to the idealisation of "proletarian violence" as a thing good in itself. The syndicalism of M. Sorel has probably more affinity, however, to the anarchism of Nietzsche and the *élan vital* of Bergson than to any conscious aims

of French trade unionists. The word first came into general use in Great Britain about 1912, when the coal strike was widely attributed to political agitators, and the followers of Tom Mann formed the Industrial Syndicalist Education League.

Since that time the more moderate proposals of the *Guild Socialists* (*see* SOCIALISM) have largely taken the place of syndicalism as a method of controlling industry advocated by intellectual leaders of the British Labour movement, while the more extreme advocates of social revolution have been diverted by events in Russia from French syndicalism to Marxian socialism.

To advocate that the means of production in each trade should be owned by a union of the workers in that trade is, to some extent, to return to the attitude of the early Socialists, such as Robert Owen and William Morris. Morris desired that everything made should be "a joy to the maker and the user."

He thought less of the material wealth of the worker than of his spiritual welfare. In this the Syndicalist is with him. He demands that the worker shall control the conditions under which he works, and shall take a conscious part in production, so that he may feel the satisfaction of creative work, and become something more than a mere cog in the machine.

That there is something in this idea, and that the more thoughtful working men and women care for "status" as well as for "wages," has been recognised in various ways during the last few years, and many devices are being tried for associating the worker with the direction of industry.

Whitley Councils, i.e. joint industrial councils representing employers and employees (as advocated in the *Report* of the Whitley Committee to the Ministry of Reconstruction), have been set up in many trades; while a definite experiment in syndicalism is being made by the Building Guilds of London and Manchester.

SYNOD (Gr. *synodos*, assembly). An ecclesiastical assembly convened to consult on Church affairs. A synod may be diocesan, composed of a bishop and the clergy of his diocese; or provincial, of an archbishop and the bishops and clergy of his province; or national, of the whole clergy of a state under a Papal legate. The convocations of the English clergy are provincial synods (*see* CONVOCATION).

Synods in the Presbyterian Church are courts of review standing between the presbyteries and the General Assembly, and embracing a certain number of associated presbyteries, the clergy and elders of which constitute the respective synods. *See* ASSEMBLY, GENERAL; PRESBYTERIANISM.

SYNODICAL PERIOD. In astronomy, the period between two successive conjunctions or oppositions of two heavenly bodies. A synodical month is a lunation, being the period from one full moon to the next full moon, or from new moon to next new moon. Owing to the sun's apparent eastward motion in the ecliptic, this is over two days longer than the sidereal month, or moon's revolution period, and its average length is 29 days, 12 hours, 44 minutes, 2·37 seconds.

SYNOVIAL MEMBRANE. The membrane lining the various joints or articulations of the higher animals, which secretes a peculiar fluid—the *synovial fluid*—for the due lubrication of the joint. The structure of the synovial membrane resembles that of the serous membranes. Its secretion is a thick viscid fluid somewhat resembling white of egg.

Synovitis, inflammation of the membrane, with increased secretion of fluid, is common. *See* WHITE-SWELLING.

SYNTAX. That part of grammar which treats of the manner of connecting words into regular sentences, or constructing sentences by the due arrangement of words or members in their mutual relations according to established usage. In every language there is some fundamental principle which pervades and regulates its whole construction, although it may occasionally admit of particular variations. In some languages the principle of juxtaposition prevails, and little diversity of arrangement is possible, as is the case in English, in which inflections are so few. The relations of the subject, the action, and the object are indicated by their respective positions.

In other languages—inflected languages like Latin or Greek—these relations are indicated by the changes in the forms of the words, and the modes of arrangement are various. Still, in the structure and disposition of sentences and parts of sentences the logical relations of the thoughts must regulate the construction, even where it appears to be most arbitrary.

SYNTHETIC CHEMICALS. A term used for chemicals prepared from the elements, to distinguish

them from those prepared from natural sources. Originally most of the chemical substances known were of plant or animal origin. Thus benzoic acid was obtained from gum benzoin, salicylic acid from oil of wintergreen, alizarin from the madder root, and indigo from the indigo plant. As chemical science advanced, the structure of compounds came to be known, and knowledge of structure in many instances suggested methods of synthesis.

The introduction of synthetic chemicals has revolutionised industrial chemistry, as the manufacturer is no longer dependent on the natural source for his supplies. For example, a few years ago it was observed that the Chile saltpetre beds were rapidly becoming exhausted, a serious matter for chemists, as these beds formed the natural source of nitric acid and the nitrates. Now, however, nitric acid and the nitrates can be prepared synthetically from the nitrogen of the air by Birkeland and Eyde's method, and large factories have been erected in Norway and other countries for the production of synthetic nitrates and nitric acid.

Ammonia can also be synthesised from its elements nitrogen and hydrogen by the method introduced by Haber, and ammonia and ammonium salts are thus prepared in considerable quantity synthetically.

Dyes were all obtained at one time from plants and plant juices. The best-known of these natural dyes are alizarin, obtained from the madder root; and indigo, from the indigo plant. These two dyes have been successfully synthesised, and now alizarin is obtained from anthracene, and synthetic indigo has superseded natural indigo. The modern dyes, e.g. *azo dyes*, *sulphur dyes*, *phthalein dyes*, and *aniline dyes*, are all synthetic products.

Drugs were formerly always obtained from vegetable and animal sources, but now many are prepared synthetically, e.g. phenacetin, aspirin, salol, adrenaline, paraldehyde, and novocaine. Many antiseptics and preservatives, such as the phenols and salicylic acid, are synthetic chemicals; and rubber, originally obtained exclusively from the rubber plant, can now be synthesised from the substance *isoprene*.

Sugars have been synthesised from carbon dioxide and water, and sugar substitutes, such as *saccharine*, are also built up artificially. Many *perfumes* once obtained from flowers are now prepared chemically, e.g. heliotrope perfume from piperonal, and violet perfume from ionone. Flavouring *essences*, such as pear oil and pineapple oil, are obtained from synthetic esters.

SYPH'ILIS. A disease usually communicated by impure sexual connection. It is a contagious and hereditary venereal disease, characterised in its primary or local stage by chancres or ulcers on the genitals, succeeded by inguinal buboes. The indications of a secondary or constitutional affection are ulcers in the throat, copper-coloured eruptions on the skin, pains in the bones, nerves, etc. The name of this disease is traced to a poem written in Latin hexameters by the Italian Fracastoro, and published in 1530.

It is impossible to say when or where the disease originated, but it appears to have occurred in Europe and certain parts of Asia from the earliest times, and has gradually spread over the whole globe. During the latter part of the fifteenth century it spread throughout Europe. Schaudinn and Hoffmann, in 1905, described the parasite, *Spirochæta pallida*, to which the disease is due.

Since 1910, when Ehrlich introduced the arsenic-containing drug salvarsan, treatment of the disease has been greatly improved. The efficacy of bismuth preparations was proved in 1920, and, though not used as a substitute for arseno-benzol treatment, are administered as an adjuvant.

SYRA (ancient **Syros**). A rocky, barren Greek island of the Cyclades. Syra, or Hermoupolis (pop. 18,000), a seaport, is the capital. Area, 42¼ sq. miles; pop. 35,000.

SYR'ACUSE (*Siracusa*). A department of Italy, in the island-province of Sicily. Area, 852 sq. miles; pop. (1931), 284,369.

SYRACUSE (*Siracusa*). A seaport of Sicily, capital of the department of Syracuse, anciently capital of the island; served by rail from Catania. The ancient city was of a triangular form, 22 miles in circuit, and consisted of four parts surrounded by distinct walls; the modern city is confined to the small island of Ortygia, and is only about 2½ miles in circuit. It has some interesting remains. The cathedral partly consists of an ancient Greek temple (perhaps of Pallas Athene).

Syracuse was founded by a colony of Corinthians under Archias (734 B.C.), and, according to Thucydides, possessed a greater population than Athens or any other Grecian city.

Among the most famous of its ancient Greek rulers were Gelon, Dionysius, the elder and the younger, and Hiero I. and II. A besieging

Athenian force was annihilated in 414 B.C.; it fell into the hands of the Romans (212 B.C.), and continued in their possession till the downfall of their empire. In A.D. 878 it was destroyed by the Saracens, and the mainland portion of the city has never since been rebuilt. Oranges and lemons, earthenware, and drugs are now exported. Pop. (1931), 50,096.

SYRACUSE. A city of New York, United States, the county seat of Onondaga county; served by the West Shore, New York Central, and Delaware Railways, and by Oswego and Erie Canals. Niagara Falls electric power is used by local factories, which produce clothing, foundry and machine-shop products, typewriters, etc. Settled in 1805, Syracuse became a city in 1847. Pop. (1930), 209,326.

SYR-DARIA, or **JAXARTES.** A river of West Turkistan, rising on the "roof of the world" in the Tian Shan, and discharging to the Sea of Aral after a course of 1500 miles; drainage area, 325,000 sq. miles.

SYRIA AND LEBANON. Former Turkish territories in Asia Minor now held by France under League of Nations mandate. They are bounded by the Mediterranean, Turkey, Mesopotamia, Arabia, and Palestine. The country originally consisted of five territories: (1) Damascus (sanjaks of Damascus, Hama, Homs, and the Hauran); (2) Aleppo (sanjaks of Aleppo, Alexandretta, and Deir ez Zor); (3) Alaouite (sanjaks of Latakia and Tartous); (4) Great Lebanon (stretching along the Mediterranean from the Nahr-el-Chebin to Palestine); (5) Jebel Druze (south of the Hauran).

Since January, 1925, Damascus and Aleppo have been united to form the Syrian Republic, and a Provisional Government set up in 1928 held an election for a Constituent Assembly. A Constitution was drawn up and submitted for the approval of the mandatory power. Each of the remaining territories has partial autonomy, and in 1926 Great Lebanon (the Lebanon Republic) declared its absolute independence. There is a High Commissioner resident at Beirut, and the whole country is in French military occupation.

Damascus, the former capital of the Syrian Federation (Damascus, Aleppo, and Alaouite were united from 1920 till 1925), is now capital of the Syrian Republic. The total area is *c.* 60,000 sq. miles; pop. 2,831,622 (including Great Lebanon area, 4500 sq. miles; pop. 862,618). The bulk of the people are of Arabic origin. The chief religion is Sunni Mahommedanism, but there are many Shi'ites, 505,419 Christians, and about 86,125 Druses (q.v.).

The chief towns are Damascus, Aleppo, Beirut (capital of Great Lebanon), Homs, Hama, Tripoli, Antioch, Latakia, and Alexandretta. The chief ports are Beirut, Tripoli, Alexandretta, Latakia, and Saida (Sidon). There are numerous French schools, British and American mission schools, and Greek and Roman Catholic schools. There is a Jesuit university in Beirut. The coastal plain rises abruptly to the Lebanon range (Dahr-el-Kadhib, 10,018 feet) and the Anti-Lebanon range, which run parallel to the coast, and between which is the valley of Cœle-Syria, watered by the Orontes.

This mountain plateau gradually merges into desert in the south and east. Rivers flowing to the sea are short (except the Orontes), while those to the east of the mountains are lost in the desert. The north-east of the country is crossed by the Upper Euphrates.

Syria is essentially agricultural. The chief products are wheat (in 1931, 386,717 metric tons, mainly from the Hauran), barley, millet, maize, oats, olives, grapes, and fruits of all kinds (particularly round Damascus), tobacco, sesame, chick-peas, cotton, and sugar-cane. Mineral resources are poor, but good iron ore is worked in Northern Lebanon. There are about 1660 miles of railway, 190 on the Baghdad Railway and 620 on the Hejaz Railway. An air mail service is maintained between Beirut and Marseilles.

After the fall of the Assyrian Empire, Syria passed successively to the Persians, Greeks, Romans, Arabs (636), Seljuk Turks (1078), Crusaders (till 1293), Mamelukes, and Ottoman Turks (1517). It was conquered by Mehemet Ali of Egypt in 1833, and restored to Turkey in 1840. British, French, and Arab troops drove the Turks from Syria and Lebanon in 1918, and in 1920 the Supreme Council (San Remo) granted the mandate to France.

The mandate, which included Cilicia (restored to Turkey in 1922), was confirmed by the League of Nations (1922). The independence of Syria and Lebanon was recognised by the abortive Treaty of Sèvres (1920) and by the Treaty of Lausanne (1923). In 1920 the Emir Feisal (later King of 'Iraq) was proclaimed King of Syria by the Syrian Congress at Damascus. The French, however, drove him out.

In 1925 the Druses of the Hauran (who have always been friendly to Britain) revolted against the adminis-

tration of General Sarrail, the French High Commissioner. Brigands attacked Damascus, the French shelled the city, and Sarrail was recalled. Trouble, however, continued throughout 1926, mainly owing to irritation at the French policy of control, but peace was secured in 1927. In 1930 a new Republican Constitution was proclaimed by the French High Commissioner. The Parliament was elected in 1932.—BIBLIOGRAPHY: *Handbook to Syria* (prepared by the Admiralty); G. Bell, *Syria*.

SYRIAC LANGUAGE AND LITERATURE. Syriac is the Aramaic dialect of Edessa and Western Mesopotamia, and thus one of the Semitic family of languages. It ceased to be spoken as a living language about the tenth century A.D. The oldest work in the language still extant is the incomplete translation of the Bible called the *Peshita*. Another version, the Syro-Philoxenian, made by Philoxenus, Bishop of Hierapolis (488-518), is partly in existence. The most learned representative of the old orthodox Syrian Church is undoubtedly Ephraem Syrus, who flourished in the fourth century.

SYRINGE. An instrument consisting of a cylinder of metal or glass fitted with an air-tight piston, which can be moved backwards and forwards in the cylinder by hand. To use the simplest form of syringe, which has no valves, the piston is driven home in the cylinder, the nozzle inserted in the liquid, and the piston withdrawn. The liquid is thus forced into the cylinder by atmospheric pressure.

SYSTEMS, RAILWAY. It is proposed here to enumerate some of the most important transcontinental lines and steamer connections, as a supplement to the railway data embodied in the geographical and other articles, which should be consulted where references to them are made in the text. Most of the great trunk lines depend for their general direction and their grades upon the topography of the country served.

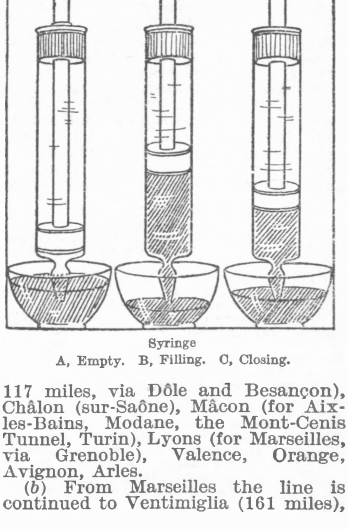
1. **London-Paris.** There are four main routes, all of which are operated on the British side by the Southern Railway.

(*a*) London	Victoria-Newhaven,	56½ miles	Total 253½ miles	Paris (St. Lazare Station): running over the French State Railways. Havre and Dieppe lines join at Rouen (Right Bank Station).
	Newhaven-Dieppe,	74 ,,		
	Dieppe-Rouen,	38 ,,		
	Rouen-Paris,	85 ,,		
(*b*) London	Waterloo-Southampton,	74 ,,	Total 340 miles	
	Southampton-Havre,	126 ,,		
	Havre-Rouen,	55 ,,		
	Rouen-Paris,	85 ,,		
(*c*) London	Victoria-Folkestone,	70 ,,	Total 259 miles	Paris (Nord Station): running over French Chemin de Fer du Nord. The Calais-Paris line is via Boulogne.
	Folkestone-Boulogne,	31 ,,		
	Boulogne-Paris,	158 ,,		
(*d*) London	Victoria-Dover,	77 ,,	Total 287 miles	
	Dover-Calais,	25 ,,		
	Calais-Paris,	185 ,,		

From Paris (Nord) to Paris (P.L.M.) there is a junction line.

2. **P.L.M.** (Paris-Lyons-Mediterranean). This is a remarkable railway that runs southwards through the heart of France, from Paris to Marseilles, a distance of 536 miles. (*a*) The line runs via Moret, Sens, Joigny, Tonnerre, Dijon (for Belfort, 117 miles, via Dôle and Besançon), Châlon (sur-Saône), Mâcon (for Aix-les-Bains, Modane, the Mont-Cenis Tunnel, Turin), Lyons (for Marseilles, via Grenoble), Valence, Orange, Avignon, Arles.

(*b*) From Marseilles the line is continued to Ventimiglia (161 miles),



Syringe
A, Empty. B, Filling. C, Closing.

via Toulon, Cannes, Nice, Monte Carlo, Mentone; and from Ventimiglia to Genoa (94 miles), via San Remo and Savona [1] (*see* PORTO MAURIZIO; RIVIERA). (*c*) A second line runs from Paris to Nîmes (299 miles), via Moret, Montargis, Nevers, Moulins, Varennes, St. Germain des Fosses, Gannat, Riom (for Chatel-Guyon) [2], Alais, Nozières. (*d*) There is an extension to Cette (48 miles), for Narbonne and Barcelona [3(*d*)] [3].

3. **France-Spain.** (*a*) From Paris to Orleans (by Orleans Railway) is 78 miles. (*b*) After Orleans there are two alternative routes; the first of which (western) runs via Blois, Tours (for Angers, Nantes, Le Croisic), Poitiers, Angoulême, and Coutras to Bordeaux, a distance of 217 miles. (*c*) Southwards from Bordeaux the line passes via Lamothe (for Arcachon on the coast, 10 miles), Dax (for Pau, 53 miles), Bayonne, Biarritz, and Hendaye over the Spanish frontier (*see* SPAIN, section *Communications*) to Irun [4]. (*d*) The eastern line runs from Orleans to Toulouse (367½ miles), via Vierzon, Châteauroux, Argenton, Limoges [5], Brive, Cahors, and Montauban; thence along a section of the Southern Railway, via Castelnaudary and Carcassonne, to Narbonne (93 miles), where the P.L.M. line from Marseilles via Cette [2(*d*)] joins on. Narbonne to Portbou (for Barcelona), via Perpignan and Cerbère, is 66½ miles. Toulouse to Barcelona, via Portbou, is 263 miles. (*e*) Barcelona to Madrid, via Zaragoza (214 miles), is 426 miles; and from Zaragoza there is a line to Alasua on the line from Irun to Madrid (*see* SPAIN).

4. **Madrid-Gibraltar.** From Madrid, Gibraltar is reached via Algeciras (463 miles), running southwards over the line to Sevilla (360 miles), via Alcazar de San Juan (92 miles) and Manzanares, as far as Cordoba (275 miles), where the line from Malaga is joined and followed as far as Bobadilla. From Bobadilla the line runs via Ronda to Algeciras, where the steamer is joined for Gibraltar, 5½ miles away.

5. **Paris-Rome.** Leaving the P.L.M. station, the P.L.M. line [2(*a*)] is followed as far as Dijon; thence via the Paris-Istanbul line [6] through Domodossola to Milan; and on via Lodi and Piacenza to Parma, Modena, and Bologna. From Bologna the line runs through Pistoja and Florence, and through Central Italy to Arezzo and Terontola; past Lake Trasimene to Orte, Monterotondo, and Rome. From Milan to Rome is 413 miles [6(*c*)]. Ancona is reached from Bologna and Orte.

6. **Paris-Istanbul.** This is the route followed by the Simplon-Orient express. (*a*) From the P.L.M. station along the P.L.M. line to Dijon is 196 miles. (*b*) Thence Lausanne (121 miles) is reached via Mouchard, Frasne, Vallorbe. (*c*) The third stage is Lausanne to Milan (192 miles), along the north shore of the lake of Geneva, past Vevey, Montreux, and Villeneuve; thence southwards along the Rhône Valley to Roche, Aigle, St. Maurice, following the eastward bend of the valley to Sion and Brig (90½ miles).

(*d*) Brig is the entrance to the great Simplon Tunnel (through the Alps); and here the line joins that from Bern, via Thun and Spiez on the southern shore of the Thuner See, passing across the Bernese Oberland via Kandergrund and the Kander Tunnel. Bern to Brig is 72 miles. (*e*) Brig to Domodossola (Italy) through the Simplon Tunnel is 25¼ miles.

(*f*) From Domodossola the Simplon express traverses the west shore of Lake Maggiore, running via Pallanza, Baveno, and Stresa to Arona, Gallarate, and Milan (76¼ miles from Domodossola). (*g*) Milan (Centrale) to Venice is 165 miles, via Brescia, Desenzano (on the Lake of Garda), Verona, Vicenza, and Padua. (*h*) Venice to Trieste (q.v.) is 99 miles, via Mestre and Portogruara to Monfalcone; thence by way of Nabresina.

(*i*) Trieste to Postumia is 52 miles. The express leaves Trieste (Centrale) and runs via Nabresina to Sesana, Divaccia, and San Pietro (Sankt Peter), the junction for Fiume; thence to Postumia (Adelsberg) and (*j*) over the frontier of Yugoslavia to Laibach (Ljubljana). Postumia to Ljubljana is 38 miles.[1] (*k*) Zagreb (Agram) is reached from Ljubljana via Steinbrück, and the line is con-

[1] Savona is the terminus of the line to Turin (91 miles), via San Guiseppe and Bra.

[2] A place with iron springs and bathing establishments, in the French department of Puy-de-Dôme (q.v.).

[3] The bracketed figures cross-refer to the initial numbers, and the letters to the alphabetical subdivisions of paragraphs in this article.

[4] From Bayonne to Irun (23 miles) is a French Southern (Midi) Section. The Southern has its headquarters at Toulouse, which is connected with Bayonne by a line (200 miles) round the base of the Pyrenees, via Tarbes and Pau.

Toulouse to Bordeaux by Southern Railway, via Montauban and Agen, is 160 miles. There is through communication with Cette from Bordeaux, via Toulouse, and the line to Narbonne, dealt with in 3(*d*) above. Bordeaux to Cette is 296 miles. Bordeaux to Bayonne by Southern Railway is 123 miles.

[5] Angoulême and Limoges are connected by rail via St. Junien. Clermont-Ferrand to Limoges is 135 miles. Brive is the junction for Toulouse, via Villefranche.

[1] See *Styria*.

tinued across Slavonia to Vinkovce.[1]

From Vinkovce the express runs by India [2] and Semlin (Zimony) to Belgrade (for Nish by way of the Marava Valley, thence to Salonika and Athens); and from Belgrade across Bulgaria via Tsaribrod to Sofia; south-westwards thence to Edirne (Adrianople), and from Edirne by the Maritza and Ergene Valleys to Istanbul. Belgrade to Istanbul is 659 miles.

7. **London-**{Dover-Calais / Dover-Ostend*}**-Brussels.**

* Belgian State Railways and Mail Packet Services.

8. **Brussels-Hamburg,** via Liége, Herbesthal, Aix-la-Chapelle, Cologne [see 12], Düsseldorf, Oberhausen (for Hamm, Hanover, Stendal (q.v.), and Berlin), Haltern, Bremen.[3] (*a*) Hamburg-Warnemünde, via Lubeck and Rostock. (*b*) Berlin-Warnemünde, via Neu Strelitz. (*c*) Warnemünde by steamer to Gjedser (on Falster) for Copenhagen. (*d*) Hamburg-Kiel, via Altona; steamer to Korsör (for Copenhagen). (*e*) Hamburg-Sassnitz Hafen, via Rostock and Stralsund. (*f*) Berlin-Sassnitz Hafen. (*g*) Steamer, Sassnitz Hafen-Trelleborg; thence via Malmö to Stockholm, Göteborg, and Oslo.

9. **Copenhagen - Stockholm** (by steamer to Malmö).

10. **Berlin-Riga** (q.v.), via Schneidemühl (for Thorn and Warsaw), Dirschau (for Danzig, *see* STETTIN), Gumbinnen, Eydtkuhnen (for Wirballen, Kovno, Riga). *See* PRUSSIA, EAST (section *Communications*).

11. **Berlin-Warsaw** (for Moscow), via Frankfurt-on-Oder, Posen (q.v.), Thorn, Alexandrowo.

12. [See 8.] **London-Cologne,** via Folkestone and Flushing (Vlissingen). From Victoria to Folkestone is 70 miles; Folkestone to Flushing is 100 miles; thence via Roosendaal to Breda, where a line from Rotterdam (31 miles) joins; and via Tilburg, Boxtel, Eindhofen (for Liége, 68½ miles, via Hasselt), and Venlo to Krefeld, Neuss (for Düsseldorf), and Cologne [15 (*a*), (*b*)]. Breda is 68 miles from Flushing.[4]

13. **London-Central Europe,** via Harwich and Hoek van Holland. Hook of Holland, via Schiedam, to Rotterdam is 17½ miles. Rotterdam is the junction for The Hague (15½ miles) and Amsterdam (54 miles). From Rotterdam the line runs across Holland, via Utrecht, Amersfoort, Rheine, to Osnabrück, Lönn, Minden, Hanover (for Brunswick, Stendal, Berlin). From Hanover to Brunswick is 37½ miles; thence the line runs, via Magdeburg, Halle, Leipzig, and Riesa, to Dresden (242 miles from Hanover). Dresden is a junction for the Berlin-Vienna (400 miles) line, some 120 miles from Berlin and 119 miles from Prague.

14. **London-Bucharest.**

(*a*) London-{Ostend-Brussels (Nord)-Luxemburg / Calais-Paris (Est)-Sarrebourg}-Strasbourg.

(*b*) From Strasbourg the line runs across the Rhine, via Kehl, to Appenweier, where it joins the line from Bâle (Basel), via Offenburg, and runs down the right bank of the Rhine, via Baden-Baden, to Karlsruhe, Durlach, and Bruchsal, the junction for Stuttgart, via Mühlacker. From Stuttgart the route is via Cannstatt to Ulm, thence to Munich, the Bavarian capital, via Günzburg and Augsburg. Stuttgart to Munich is 150 miles. Leaving Munich, the frontier is crossed at Salzburg (q.v.), and Vienna is reached. Stuttgart to Vienna is 440 miles.

At Vienna lines for Bucharest, Budapest, and Belgrade have their nodal point. (*c*) Vienna to Bucharest is 723 miles, and Vienna to Budapest is 173 miles. For Budapest the line runs out of the Ostbahnhof to the Czechoslovakian frontier at Bratislava (Pressburg), crosses Southern Slovakia, and then enters Hungary.

From Budapest (Westbahnhof) direct connection is afforded with Bucharest, via Szolnok, Bekescsaba, and Ketegyhaza, and over the Rumanian frontier to Arad; thence across Transylvania, by way of Segishoara, Brasov, Predeal, Sinaïa, and Ploesti, to Bucharest.

(*d*) Vienna to Budapest, via Bruck and Györ to the Czechoslovakian frontier at Komorn, is 168 miles. (*e*) Vienna to Belgrade is 391 miles from the Ostbahnhof, running south, via Kis-Körös, to Szabadka, and across the Danube to Semlin (Zimony) and Belgrade. (*f*) Belgrade to Istanbul. There is direct communication via Nish and Sofia; Vienna to Istanbul is 1050 miles.

15. **Cologne-Vienna.**

(*a*) London-{Ostend-Brussels-Herbesthal / Rotterdam-Nymegen-Krefeld}-Cologne [8; 12].

(*b*) From Cologne the railway follows a south-easterly direction along the right bank of the Rhine, via Beuel, Linz, Neuwied, Vallendar, and Niederlahnstein (for Coblenz),

[1] Vinkovce is a junction for the Banat; a line runs to Temisoara; thence to Orsova and Bucharest (for Constanta and steamer to Istanbul). There is a through service from Trieste to Boulogne. The Simplon-Orient express runs between Paris and Istanbul; the return journey is performed by the Orient-Simplon express. Both services also serve Athens.

[2] India = Indjija.

[3] See *Syke.*

[4] See *Rhenish Prussia.*

to Eltville (for Schlangenbad, 5 miles), Wiesbaden (for Mainz), Kastel, Höchst, and Frankfurt. Cologne to Frankfurt is 140 miles. Leaving Frankfurt, and running over the Bavarian railways, Würzburg is reached, via Hanau, Aschaffenburg, Gemünden, and the Main Valley; thence to Nürnberg (for Karlsbad and Baireuth); and from Nürnberg south-east to Regensburg (Ratisbon) and Passau (Austrian frontier), where the Salzburg-Vienna line (*see* SALZBURG) is joined and followed to Vienna, via Linz, Amstetten, St. Polten. Cologne to Vienna is 687 miles.

Canadian Railways. The Canadian National system has a mileage of 22,757, and is easily the greatest State-owned railway system in existence. The main divisions and their mileages are as follows:

	Miles
Canadian Northern	9320·15
Grand Trunk	3567·07
Grand Trunk Pacific ..	1681·58
,, ,, (Branches) ..	1032·63
National Transcontinental ..	2002·92
Intercolonial	1592·35
Total ..	19,196·69

The Transcontinental lines of the National system, from Montreal to Vancouver, have a total distance of 2937·5 miles, and attain an altitude of 3650 feet at Lucerne. Toronto to Vancouver service is *via North Bay*. Montreal to Winnipeg is 1309 miles. Winnipeg to Prince Rupert is 1751 miles, the line attaining an altitude of 3714 feet at Mount Cavell. The Canadian Pacific Railway has a mileage of about 14,820, and the through line to Vancouver from Montreal has a length of 2893 miles, reaching an altitude of 5213 feet at Hector.

Toronto is connected with this line, via Sudbury Junction, by a line (260 miles) along the shores of Georgian Bay. Toronto to Vancouver is 2706 miles. Besides the Canadian Pacific system, the company controls the Mineral Range (70 miles), Minneapolis, St. Paul, & Sault Ste. Mari (4384 miles), and the Duluth, South Shore, & Atlantic (610 miles) Railways. Among a multitude of smaller lines, the Temiskaming & North Ontario Railway, with a total mileage of 47, is of great economic importance. It is the property of the Ontario Government.

A great deal of miscellaneous information regarding railways is scattered throughout *The British Encyclopedia* in connection with articles on places, provinces, and countries, etc. Under *Spanish Town* the Jamaican railway system is outlined; under *Rio Grande do Sul* there is a note on Brazilian railways; and the Salvadorian system is summarised under *Union, La.* See also (for example) *Poti*; *South-West Africa*; *Tirol*; *Trieste*; and consult the Index.

SYZRAN, or **SYSRAN.** A town of Soviet Russia, in the former government of Simbirsk, on the Volga. It has tanneries, flour-mills, etc., and exports grain. Pop. 48,458.

SYZYGY (si'zi-ji). In astronomy, the conjunction or opposition of any two of the heavenly bodies. *See* MOON.

SZARVAS (sår'vâsh). A town of Hungary, on the Körös. It is an agricultural centre. Pop. 25,490.

SZATMAR-NEMETI. A town of Rumania, formerly a royal free town of Hungary, on the Szamos. Pop. 35,000.

SZECHWAN. A western frontier province of China, the largest in the Republic. Ch'êngtu is the capital. Area, 218,533 sq. miles; pop. 52,063,606.

SZEGED, or **SZEGEDIN.** A city of Hungary, at the confluence of the Maros and Tisa. It is a great commercial centre, with large salt and tobacco magazines, and a considerable shipping trade, especially in coal and timber, and is the second city of Hungary. Pop. 135,131.

SZOLNOK (sol'nok). A market town and railway junction of Hungary, on the Theiss and the Zagyva. It is an agricultural centre. Pop. 38,730.

T

T. The twentieth letter in the English alphabet, a sharp mute consonant, representing the sound produced by a quick and strong emission of the breath after the end of the tongue has been placed against the roof of the mouth near the roots of the upper teeth. By Grimm's law *t* in English corresponds to *d* in Latin, Greek, and Sanskrit, and to *ss* or *z* in German.

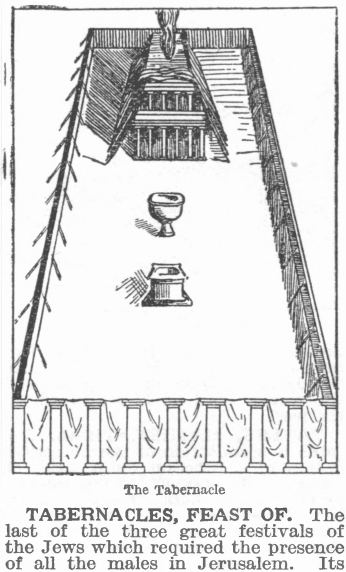
TABAS'CO. A maritime state of Mexico, between Yucatan Peninsula and Vera Cruz; area, 10,374 sq. miles. It consists almost entirely of a great flat sloping northwards to the Gulf of Mexico. Villa Hermosa is the capital. Pop. (1930), 223,838.

TAB'ASHEER, or **TABASHIR** (Persian). A siliceous concretion resembling hydrophane, sometimes found in the joints of bamboos and other large grasses. It is highly valued in the East Indies as a medicine, but its virtues are merely imaginary.

TABERNACLE (Lat. *tabernaculum*, small hut). In Jewish antiquities, the tent or sanctuary in which the sacred utensils were kept during the wanderings of the Israelites in the desert. It was in the shape of a parallelogram, 45 by 15 feet, and 15 feet in height, with its smaller ends placed east and west, and having its entrance in the east. Its framework consisted of forty-eight gilded boards of shittim-wood, bound together by golden rings and set into silver sockets; and this framework was covered with four carpets.

The interior was divided by a curtain into two compartments, the outer the "sanctuary" proper, and the innermost the holy of holies. In the sanctuary was placed on the north the table of shew-bread, on the south the golden candlestick, and in the middle, near the inner curtain, the altar of incense. In the centre of the holy of holies stood the ark of the covenant. The tabernacle was situated in a court 150 by 75 feet, surrounded by costly screens 7½ feet high, and supported by pillars of brass 7½ feet apart, to which the curtains were attached by hooks and fillets of silver.

In the outer or eastern half of the court stood the altar of burnt-offering, and between it and the tabernacle itself the laver for the ablutions of the priests. Modern critics do not admit that the Jews could have possessed such a structure in their wanderings.



The Tabernacle

TABERNACLES, FEAST OF. The last of the three great festivals of the Jews which required the presence of all the males in Jerusalem. Its object was to commemorate the dwelling of the Israelites in tents during their sojourn in the wilderness, and it was also a feast of thanksgiving for the harvest and vintage.

The time of the festival fell in the autumn, when all the chief fruits were gathered in, and hence it is often called the "feast of the ingathering." Its duration was strictly only seven days, but it was followed by a day of holy convocation of peculiar solemnity. During the seven days the people lived in booths erected in the courts of houses, on the roofs, and in the court of the temple. It was the most joyous festival of the year.

TABES. A term used to describe a state of gradual progressive emaciation of the body. The term is most frequently used in relation to two diseases: tabes mesenterica, which is abdominal tuberculosis (q.v.) in children; and tabes dorsalis, or locomotor ataxia, one of the commonest of the chronic diseases of the nervous system.

TABLE-LAND. *See* GEOGRAPHY.

TABLE MOUNTAIN. A mountain of South Africa, south of Table Bay, its highest point being right over

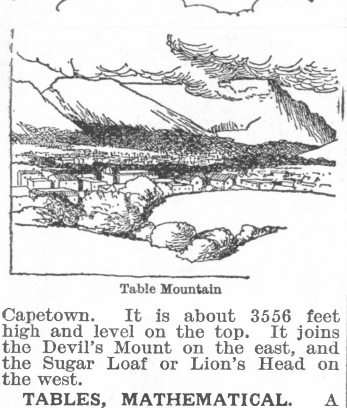


Table Mountain

Capetown. It is about 3556 feet high and level on the top. It joins the Devil's Mount on the east, and the Sugar Loaf or Lion's Head on the west.

TABLES, MATHEMATICAL. A table is a collection of the numerical values of a function for a series of values of its argument or arguments. In general, the data brought together in a table are useful for their own sake; but some tables, notably those of common logarithms, are chiefly valuable as aids to arithmetic. Tables of quarter-squares, for example, allow the product of two numbers to be found by addition and subtraction, from the formula $ab = \frac{1}{4}(a+b)^2 - \frac{1}{4}(a-b)^2$; J. Blater's *Table of Quarter-Squares* (London, 1888) gives by this method the product of any two 5-figure numbers.

P. Barlow's *Tables* (London, 1840), which are extensively used, give squares and cubes, with square roots and cube roots, of numbers to 10,000; and also reciprocals to 9 or 10 places. G. A. Jahn's *Table of Square and Cube Roots* (Leipzig, 1839) gives these to 25,500.

Before the invention of logarithms, the most important tables were those of the trigonometrical functions, such as the sine and the cosine. George Joachim Rheticus (1514-76) is famous for his tables of this kind, on which he is said to have had computers constantly at work for twelve years. His *Opus Palatinum* gives all the ratios to 10 places for every 10 seconds from 0° to 90°.

The calculation of the common logarithms of numbers and of the trigonometrical ratios is almost entirely due to Henry Briggs, and to the Dutchman Adrian Vlacq, who followed Briggs and completed his work.

The *Arithmetica Logarithmica* of Briggs appeared in 1624, and his *Trigonometria Britannica* in 1633. The latter contains log sines (to 14 places) and log tans (to 10 places) for every hundredth of a degree in the first quadrant. V. Bagay's *Nouvelles Tables* (Paris, 1829) contains complete results for the logarithms of the trigonometrical ratios to every second, and has been much used by computers. R. Shortrede's *Logarithmic Tables* (Edinburgh, 1849) also gives the trigonometrical canon complete to every second.

A famous set of tables, never completely printed, but always available in manuscript, is the *Tables du Cadastre* of Prony, commenced in 1784 at the instance of the French Government. In 1891 an abridgment was published officially, in the form of an 8-figure centesimal table to every 10 seconds. Edward Sang's *Tables* (1871) give 7-figure logs of numbers from 20,000 to 200,000, and those of W. W. Duffield (1896) give 10-figure logs to 100,009.

Among more miscellaneous tables, a very popular set has been that of C. Hutton (1785), which contains hyperbolic logs to 1200 to 7 places. F. Callet's *Tables Portatives* (Paris, 1783 and 1853) is a very complete collection of tables of ordinary and hyperbolic logs. Tables by G. Vega and by J. C. Schultze have been much used. The latter contains Wolfram's table of hyperbolic logs of numbers below 10,000 to 48 places. Barlow's *Tables*, already mentioned, give 8-place hyperbolic logs.

The collections of Luvini and Chambers are suitable for use in Schools. In J. B. Dale's 5-figure tables, among the functions tabulated are elliptic functions, the gamma function, zonal harmonics, and Bessel Functions. The more recent *Funktionentafeln* of Jahnke and Emde also contains matter of this type, with many of the relative formulæ.

Tables of e^x and e^{-x} are given by F. W. Newman and by J. W. L.

Glaisher in the *Cambridge Philosophical Transactions*, vol. xiii., pp. 145 and 243. For the Bessel Functions, extensive tables are given in the treatise on these functions by Gray, Matthews, and MacRobert. Many tables have been published of the kind required in actuarial work; a short set is appended to the *Institute of Actuaries' Text-book*. —BIBLIOGRAPHY: *British Association Report for* 1873, p. 6; R. Mehmke, article *Numerisches Rechnen* in vol. i., part 2, pp. 941-1079 of the *Encyklopädie der Mathematischen Wissenschaften*.

TABLES, THE. In Scottish ecclesiastical history, the permanent council held in Edinburgh for managing the affairs of the Covenanters during the reign of Charles I., said to have been so named from a green table at which the members sat.

TABOO. A Polynesian word used to denote something consecrated, sacred, forbidden to be touched, or set aside for particular uses or persons. It is applied both to persons and things, and both to the object prohibited and to the persons against whom the prohibition extends. The word taboo was introduced into English by Captain Cook, who became acquainted with it in 1777 at Tonga.

The institution of taboo has been variously explained. It has been regarded as a cunning piece of statecraft, devised by priests and political chiefs; as a religious observance; and as an inherent tendency in man. It may also be the expression of conservatism, social and religious. Anyhow, the belief in a mysterious spiritual potency and fear were the chief causes inspiring taboo.—BIBLIOGRAPHY: Sir J. G. Frazer, *The Golden Bough*; F. B. Jevons, *An Introduction to the History of Religion*.

TABOR. A town of Czechoslovakia, on the River Luznitz. Its castle was a stronghold of the sect of Hussites called Taborites, and there are old walls. Altitude, 1470 feet. Pop. 14,251.

TABRIZ' (ancient **Tauris**). A city of Persia, capital of the province of Azerbaijan, on the Aigi, 36 miles above its entrance into Lake Urumiyah. It is surrounded with a wall of adobe, and has mosques, bazaars, baths, and caravanserais.

There are manufactures of silks, cottons, carpets, and leathers, etc., and Tabriz is the commercial metropolis of North-Western Persia. During the European War the town was seized by the Turks in 1915, and again in 1918. In 1922 it was for a short time in the possession of Caucasian Bolsheviks. Pop. 180,000.

TACAHOUT (tak'a-hut). The small gall formed on the tamarisk tree (*Tamarix indica*). It is imported into Britain for the sake of its gallic acid, and is used as a mordant in dyeing and in tanning.

TACAMAHAC'. The name given to a bitter balsamic resin, the produce of several kinds of trees belonging to Mexico and the West Indies, the East Indies, South America, and North America. The balsam-poplar or tacamahac is one of these. *See* CALOPHYLLUM.

TACHOMETERS AND TACHOGRAPHS. Instruments for the measurement and recording of speed of running of machinery. The usual principle on which they operate is that two revolving masses of metal are free to move outwards from one another within the limits imposed by their connection by springs. The position they take up will vary according to the speed at which they are revolved, and motion is taken from them or from a sleeve connected to them through gearing or levers to operate the pointer on the scale.

If the instrument is to be a recording one, a pen with a small well of ink is fixed to the head of a long thin arm, and its travel on a paper indicates the change of speed. The drum on which the paper is held is usually operated to revolve by means of clockwork, and thus a time record of the change of speed may be obtained.

Vibrating reeds of different natural frequencies are used on some instruments to show the speed of running of such a plant as a steam turbine. The reeds are usually mounted at the back of the instrument, and their white ends are visible through a slot in the dial beside the scale. As the speed of the machine is raised, one after another of the reeds is set in vibration, and as a calibrated scale is provided, the actual speed at any moment may be observed.

Speed counters are commonly used in testing. In them a shaft is made to revolve at the same speed as the plant by actual contact with the end of the machine shaft, and gearing drives a dial round past an index-mark to show the number of revolutions performed while the instrument is in use.

TACHYLYTE (often misspelled *tachylite*). A pitchstone of basaltic composition, found on the rapidly cooled sides of volcanic dykes or on

the surface of some basic lava-flows.

TACITUS, Cornelius. Roman historian, born about A.D. 55; died about A.D. 120. The few facts which are known about him are derived from his own works, and from the *Letters* of the younger Pliny, who was his intimate friend. He began his public career as quæstor under Vespasian, and was tribune or ædile under Titus. Nothing is known of his family, nor is his prænomen known for certain.

He became a very successful barrister, and married the daughter of the distinguished soldier Julius Agricola. In the reign of Domitian, Tacitus was prætor at the celebration of the secular games. He became consul in A.D. 97, and in 99 was associated with Pliny in the prosecution of Marius Priscus, the extortionate governor of Africa. Tacitus seems to have been alive in A.D. 117, but probably died a few years after that date.

The extant works of Tacitus are few and fragmentary, but upon them rests a reputation unsurpassed by that of any Roman prose writer. His earliest work, the *Dialogus de Oratoribus*, was written about A.D. 76. Its authorship has been denied to Tacitus, as its style is not Tacitean, but this reason for scepticism is sufficient, as the true Tacitean style was probably a slow and a late growth.

The *Dialogus* throws an interesting light upon Roman education. The *De Vita et Moribus Julii Agricolæ* is Tacitus's pious tribute to the memory of his father-in-law. It is one of the finest short biographies ever written, and is of especial interest to Britons on account of the sketch which it gives of the British Isles.

The *De Germania* has something of the air of a pamphlet with a purpose. It exploits the fallacy of the "noble savage," in order to attack the degeneracy and servility of contemporary Rome. It is not critically written, and may be regarded as a contribution to ethics rather than to history. The *Histories* are the greatest of the extant works. They were written in twelve books, and covered the years A.D. 69 to 97. Only four books and a small part of the fifth book are preserved.

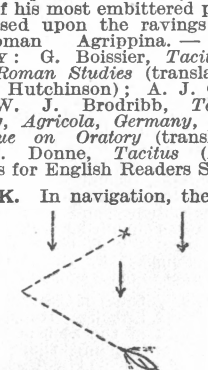
The extant books give a detailed account of the events of the year 69, the fateful "year of the four emperors." The fragmentary fifth book gives a picturesque but inaccurate account of the Jews. The *Annals* recorded the history of the reigns of the emperors from Tiberius to Nero inclusive, but only nine books are entire; the whole of the reign of Caligula, the first six years of Claudius, and the last three years of Nero are wanting.

The Emperor Tacitus, who was proud to claim his descent from the historian, during his brief reign enacted that ten copies of the works of Tacitus should be transcribed yearly at the public expense, and placed in the public libraries. The fact that, in spite of this multiplication of copies, his works are so imperfectly preserved, shows that Tacitus must always have been "caviare to the general."

His style is unique. He is a master of biting phrase and innuendo, and his language is unequalled for audacity, force, conciseness, and condensation. He is as great a literary artist as Virgil, whom he admired and frequently imitated. In the works of Tacitus also is to be found "All the charm of all the Muses often flowering in a lonely word." No prose writer equally repays constant study and re-reading.

This "lord of language" charms his readers into forgetting that he is not an impartial historian, and that some of his most embittered passages are based upon the ravings of the madwoman Agrippina. — BIBLIOGRAPHY: G. Boissier, *Tacitus and other Roman Studies* (translated by W. G. Hutchinson); A. J. Church, and W. J. Brodribb, *Tacitus—History, Agricola, Germany, and the Dialogue on Oratory* (translation); W. B. Donne, *Tacitus* (Ancient Classics for English Readers Series).

TACK. In navigation, the course

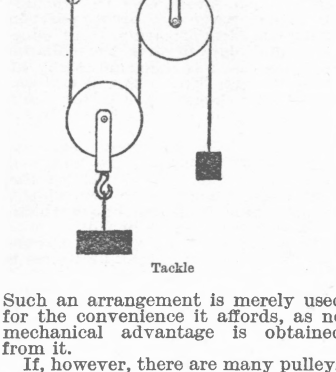


Tacking

of a ship in regard to the position of her sails and the angle at which the wind strikes them. Tacking is an operation by which a ship is enabled

to beat up against a wind by a series of zigzags, the sails being turned obliquely to the wind first on one side and then on the other.

TACKLE. A combination of pulleys and ropes or chains, the use of which facilitates the handling of heavy loads. When a rope is passed over a single pulley, a load applied to one end of it may be raised by a downward pull on the other end.



Tackle

Such an arrangement is merely used for the convenience it affords, as no mechanical advantage is obtained from it.

If, however, there are many pulleys in use, and they are arranged in two blocks, the rope being passed over a pulley in each block in turn, a great mechanical advantage is procurable. At the same time, the velocity ratio is changed, and the speed of lifting is decreased.

Neglecting friction, the rope or chain has the same tension throughout, and the mechanical advantage would be the same as the number of rope or chain lengths which take the pull. A method of obtaining a high mechanical advantage without the use of a large number of pulleys is embodied in the design of the Weston type of block. In that arrangement there is a single pulley below, but a double one above.

The pulleys of the top block, however, are cast in one piece, so that they run together. The chain is an endless one, and passes over the pulleys in turn. With such a system the amount of chain hauled in for one complete revolution of the upper pulleys is the difference of their circumferences, and the load will be lifted through half that amount. Neglecting friction, the equation connecting the load W and the effort P is

$$P\pi D = W.\frac{\pi}{2}(D - d),$$

where D and d are the two diameters of the upper pulleys. The smaller the difference in the diameters, the greater will be the mechanical advantage. A useful feature of this type of block is that, thanks to the large amount of friction in the upper block, the tackle does not *overhaul*, i.e. the load does not run back when the effort ceases.

TACNA-ARICA. Tacna was till 1929 the northernmost province of Chile, having been annexed by that country from Peru after the war of 1879-82. Under the third clause of the Treaty of Ancon (*see* PERU, *History* section), Chile, who had occupied the province in 1883, maintained her hold over it, but agreed to a plebiscite, which should have been taken in 1894, although it has never materialised.

The true position is that Chile did not know at the time the immense value of the Tacna-Arica region, which has since revealed nitrate deposits which have been estimated as workable for some five hundred years. By the Treaty of Ancon, Peru was to pay 10,000,000 *soles* on the redemption of her lost territory; but now Chile prefers the province, and has hitherto been successful in keeping it.

A most important feature of any negotiations must be the claim of Bolivia, the third largest state of Latin-America, and a mine of mineral wealth. Bolivia is, since the Treaty of Ancon, an inland state, and she insists on her moral right to a " window " on the Pacific.

Apart from her genuine and pressing economic need, such a " window " would be the only preventive of her political strangulation, the present wholesale robbery of her merchants by those on the coast, and the subordination of her national ideals and her very independence to Chilian politics, upon the goodwill of which she is now dependent for intercourse with the rest of the world. The dispute was settled in 1929, Tacna going to Peru, and Arica to Chile. Area of Tacna, 12,590 sq. miles; pop. 60,000.—Cf. Sir C. R. Markham, *The War between Peru and Chile* (1879-1882).

TACO'MA. A seaport-city of Washington, United States, the county seat of Pierce county, on an arm of Puget Sound, terminus of the Northern Pacific Railroad, a rising place with two universities, various industries, extensive docks, and trade in grain, lumber, coal,

etc. Founded in 1868, it became a city in 1883. Pop. (1930), 106,817.

TACTICS. *See* STRATEGY AND TACTICS.

TADJHIK. *See* RUSSIA (table).

TADOUSSAC. A town of Quebec, Canada. It is a health-resort and tourist centre at the Saguenay-St. Lawrence confluence. Pop. 500.

TADPOLE. *See* FROG.

TAEL. *See* CHINA (*Commerce*).

TAFF'ETA. Originally the name applied to all kinds of plain silks, but now generally used as a kind of generic name for plain silk, gros de Naples, gros des Indes, shot silk, glacé, and others. The term has also been applied to mixed fabrics of silk and wool.

TAFILELT. An oasis of the Sahara, in the French Zone of Morocco, 200 miles south of Fez. It is the cradle of the Moroccan dynasty.

TAFT, William Howard. Twenty-seventh President of the united States, born in 1857. The son of an eminent United States lawyer and diplomat, he was educated at Yale, and called to the Bar in 1880. After some experience as a journalist and in lesser official posts, he was sent to the Philippines, of which islands, in 1901, he was appointed first Civil Governor, thus becoming responsible for the re-erection of the fabric of just and orderly government on the smouldering ruins of Spanish misrule.

Here his talents were seen at their best, and Taft's ability and success were recognised by President Roosevelt, who appointed him Secretary for War, and supported his successful canditure in the presidential elections of 1909. In 1913, on the expiry of his term of office as President, he became Kent law professor of his old university.

During the European War he supported the American policy of neutrality, but on the entry of the United States he assisted the Allied propaganda. In 1921 he became Chief Justice of the Supreme Court, and after the Treaty of Versailles he was an active supporter of the League of Nations. Among his works are: *The Presidency: its Duties, its Powers, its Opportunities, and its Limitations*; and *Ethics in Service*. He died in 1930.

TAGANROG. A seaport of Russia, on the northern shore of the Sea of Azov. The chief export is grain. Pop. 86,465.

TAGETES. A genus of herbs, order Compositæ, natives of the warmer parts of America. *T. signata* is grown in gardens under the name of African marigold.

TAGLIAMENTO (ancient **TILAVEMPTUS**). A river of Venetia, North Italy, rising in the Carnic Alps and flowing eastwards and then southwards across the Friulian plain and the province of Udine, falling into the Adriatic (Gulf of Venice) after a course of 110 miles. In classical times the Tagliamento Valley was followed by the Roman road from *Aquileia* to *Julium Carnicum* (Zuglia).

During the European War the Tagliamento, swollen by the autumnal rains, played a great part in saving the Italian army from complete annihilation after the collapse (Oct., 1917) of the Second Army at Caporetto (*see* EUROPEAN WAR, section *Italian Campaign*, 1917), when a general retreat to the Piave (q.v.) was begun.

To carry out this retreat successfully it was necessary to make a stand along the line of the Tagliamento, and especially to protect the three permanent bridges, one of which, at Casarsa (south-west of Udine), was destroyed in error on 28th Oct., cutting off thousands of men and a train of guns several miles long.

Some of these troops reached the bridge at Latisana and hampered the movements of the Third Army, who were carrying out a slow, methodical retreat under cover of cavalry and motor machine-guns under the Count of Turin, and protected by the 6th and 8th Corps, who fought savage rearguard actions on the Isonzo and before Udine. Italian troops, who had been sent to oppose the Austro-German crossing in the region where the Tagliamento emerges on the Friulian plain, defeated the Austrians at Pinzano, but were ultimately forced to retire by sheer weight of numbers.

The whole of the Italian army was not demoralised after Caporetto, and, generally speaking, the retreat to the Piave was remarkable, although there were unnecessary losses in *matériel*, and a few gross blunders. Ludendorff himself did not anticipate a retirement of such magnitude (which was entirely due to the disaffected Second Army), and, as a consequence, he was not ready to follow up his momentary advantage to the full, and to extirpate the entire Italian army during its retirement.

TAGLIONI (tâl-yō'nē), **Marie.** Italian ballet dancer, born 1804, died 1884. She was trained by her father, an Italian master of the ballet; appeared at Vienna in 1822, at

Paris in 1827, and at London, where she created a great sensation, in 1838. She visited all the capitals of Europe, and was acknowledged the first ballet dancer of her time. In 1847 she retired from the stage, but subsequently, losing her savings in speculation, she supported herself in London as a teacher of deportment.

TAGORE, Rabindranath. Bengali poet and novelist, born in 1861. As a young man he spent a short while in England, where he studied law. In 1901 he founded the Shantiniketan (Abode of Peace) at Bolpur, and subsequently endeavoured to develop this institution into an international university. His poems include *Gitanjali* (Song Offerings), *The Crescent Moon*, *Songs of Kabir*, and *Stray Birds*.

His plays include *The King of the Dark Chamber*, *The Post Office*, and *Sacrifice*; and his novels include *The Home and the World* and *The Wreck*. In 1931 he published *The Religion of Man*. His works are regarded as classics in his own country, and most of them have been translated into English. He received the Nobel prize for literature in 1913. Tagore was knighted in 1915, but resigned his title in 1919 to signify his disapproval of British methods of dealing with rioters.

TAGUS (Sp. *Tajo*, Port. *Tejo*). The largest river of the Iberian Peninsula, rising in the Sierra de Albaracin and flowing by Aranjuez, Toledo, Talavera, and Alcantara, enters Portugal, passing by Abrantes, Santarem, and Lisbon to the Atlantic; length, 550 miles.

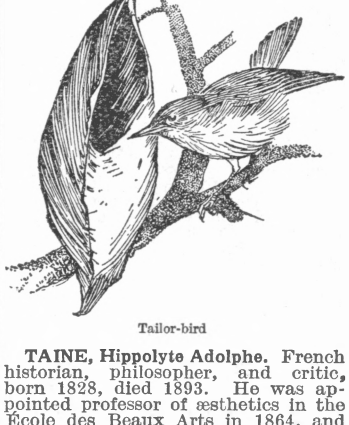
TAHITI. The largest of the Society Islands, a French possession, mountainous and of volcanic formation, fringed by coral reefs; area, 600 sq. miles. Papeete is the chief place. Citrus fruits, bananas, breadfruit, sugar, coffee, cocoa, cotton, vanilla, pearl-shell, and rum are among its products. Pop. 11,700 (1000 Europeans).

TAIHO'KU (formerly **Taipeh**). Captal of the Japanese island of Taiwan (Formosa). Pop. (1925), 195,555.

TAILOR-BIRD (*Orthotŏmus longicaudus*). A bird of the thrush family (Turdidæ), so named from its habit of sewing together leaves to form a nest; a native of India and the Eastern Archipelago.

TAIN. A royal and municipal burgh of Scotland, in the county of Ross and Cromarty, on the Dornoch Firth, one of the Wick district of burghs. Pop. (1931), 1383.

TAINAN. A town near the south-west coast of Taiwan, carrying on an extensive trade through the ports of Anping and Takow. It has rice- and sugar-mills. Pop. 58,000.



Tailor-bird

TAINE, Hippolyte Adolphe. French historian, philosopher, and critic, born 1828, died 1893. He was appointed professor of æsthetics in the École des Beaux Arts in 1864, and was elected to the Academy in 1878. His *Essai sur Tite-Live*, crowned by the Academy, appeared in 1854, and was followed in 1856 by *Les Philosophes classiques français du XIXe siècle*. In 1864 appeared his literary masterpiece, *Histoire de la littérature anglaise*. His other works include: *Essais de critique et d'histoire*, *De l'intelligence*, *Philosophie de l'art*, and *Les Origines de la France contemporaine*.

TAIT, Archibald Campbell. British prelate, born at Edinburgh 1811, died 1882. Of Presbyterian descent, he was educated at Edinburgh, Glasgow, and Balliol College, Oxford, where he became Fellow and tutor. As one of the "Four Tutors," he publicly opposed Newman in the Tractarian controversy. He was appointed headmaster of Rugby on the death of Dr. Arnold (1842), Dean of Carlisle (1850), Bishop of London (1856), and Archbishop of Canterbury in succession to Dr. Longley (1868). His primacy was marked by the disestablishment of the Irish Church, and by the Public Worship Regulation Act of 1874.—Cf. Davidson and Benham, *Life of Archibald Campbell Tait*.

TAIT, Peter Guthrie. Scottish mathematician and physicist, born in 1831, died in 1901. He was educated at Edinburgh Academy, Edin-

burgh University, and Peterhouse, Cambridge, graduating as senior wrangler and first Smith's prizeman in 1852. In 1854 he went as professor of mathematics to Queen's College, Belfast, where he made the acquaintance of Sir William Rowan Hamilton, the inventor of quaternions (q.v.), a subject on which Tait himself subsequently wrote a standard treatise. In 1860 he was elected to the professorship of natural philosophy at Edinburgh University, and continued to hold this post till within a few months of his death.

His earliest work, Tait and Steele's *Dynamics of a Particle*, was written partly in conjunction with W. J. Steele, who died, however, before the work was completed. Tait afterwards collaborated with Sir William Thomson (Lord Kelvin) in the production of a treatise on *Natural Philosophy*, one of the most important scientific works published in the nineteenth century.

The original intention of the authors was to write a work dealing exhaustively with both dynamics and physics, but the partnership was dissolved when they had covered no more than kinematics, kinetics, statics, attractions, elasticity, and some parts of hydrodynamics. At a later date Tait published volumes on *Heat*, *Light*, and *Properties of Matter*. In his treatise on *Thermodynamics* he strongly defended the claims of Joule and of Thomson, as against those of the Germans Mayer and Clausius, to be the original discoverers of certain of the most important ideas of the new science.

Tait had strong religious feelings, and was the joint author with Balfour Stewart of *The Unseen Universe, or Physical Speculation on a Future State*, which appeared anonymously in 1875 and attracted much attention. Besides the textbooks mentioned and others, Tait wrote many articles and memoirs, including a remarkable series of papers on *Knots*; and his experimental and theoretical investigations on the flight of a golf-ball excited interest beyond purely scientific circles. In practical physics he did some valuable work, notably in thermoelectricity. He was awarded a Royal medal by the Royal Society in 1886, though he had never become a Fellow of the society, preferring to identify himself with the Royal Society of Edinburgh, of which for many years he was one of the secretaries. A selection from his works has been published in three volumes.

TAIWAN (tī-wän'). *See* FORMOSA.

TAKAMATSU. A town of Japan, north coast of Shikoku. Pop. (1925), 71,897.

TAKAO, or TAKOW. A treaty port, S.W. coast of Formosa. Pop. 8000.

TAKORADI. The only sheltered harbour in Gold Coast Colony, 12 miles from Sekondi. It was opened in 1928, has a wireless station, and is thoroughly up-to-date.

TALAAT PASHA. Turkish statesman, born 1872, died 1921. From the Adrianople post office, where he was a telegraphist, Talaat, through the influence of Enver Pasha, became an important member of the Young Turk movement. With Enver he was directly responsible for Turkey's participation in the European War, and many Armenian massacres have been laid to his charge. He was a champion of the Pan-Turanian idea, but his war ambitions hastened the downfall and extinction of the Ottoman Empire.

As Grand Vizier (1917-8), in succession to the Egyptian Prince Saïd Halim, who had been too moderate for the Committee, he was a signatory to the preliminary peace imposed upon Rumania (5th March, 1918), and a Turkish delegate to Brest-Litovsk. In Oct., 1918, his position became untenable, and he resigned, being assassinated in Berlin (by an Armenian) on 15th March, 1921.

TALC. A hydrous magnesium silicate of crystalline texture, translucent, and often transparent when in very thin plates. A variety of talc called French chalk (or steatite) is used for tracing lines on wood, cloth, etc., instead of chalk (*see* POTSTONE; SOAPSTONE; STEATITE). The name talc is often erroneously given to varieties of *mica*.

TALCA. A town of Chile, capital of the province of Talca, on the Claro. Ponchos are made. Pop. (1932), 45,020.—The province has an area of 5911 sq. miles, and pop. (1930), 218,227.

TALCAHUA'NO. A seaport of Chile, in the province of Concepcion, with an arsenal, shipyards, etc. Pop. 27,594.

TALENT. The name of a weight and denomination of money among the ancient Greeks, and also applied by Greek writers to various standard weights and denominations of money of different nations, the weight and value differing in the various nations and at various times. The Attic talent as a weight contained 60 Attic minæ or 6000 Attic drachmæ, equal to 56 lb. 11 oz. British troy weight. As a denomination of silver

money it was equal to £243, 15*s.*

The great talent of the Romans is computed to be equal to £99, 6*s.* 8*d.*, and the little talent to £75 sterling. A Hebrew weight and denomination of money, equivalent to 3000 shekels, also receives this name. As a weight it was equal to about 93¾ lb. avoir.; as a denomination of silver it has been variously estimated at from £340 to £396.—Cf. G. F. Hill, *Handbook of Greek and Roman Coins.*

TALFOURD (tâl'fʊrd), **Sir Thomas Noon.** English author, born in 1795, died in 1854. He had a distinguished career at the Bar, becoming a sergeant-at-law in 1833, and a judge in 1849. As an author he is chiefly remembered for his *Ion* (1836); his other tragedies include *The Athenian Captive, Glencoe,* and *The Castilian.* He was a friend of Wordsworth and of Lamb; Dickens dedicated *The Pickwick Papers* and Browning *Pippa Passes* to him.

TALIENWAN. Chinese name for Dairen. (*See* DALNY.)

TALIESSIN. A Welsh bard said to have flourished during the twelfth or thirteenth century, and styled *Pen Beirdd,* "the chief of the bards." The *Book of Taliessin* is of a later date.

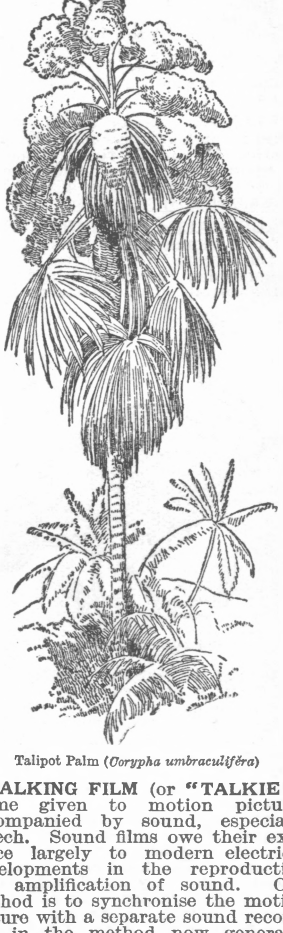
TALIPOT PALM (*Corỹpha umbraculifĕra*). The great fan-palm, a native of Ceylon. The cylindrical trunk reaches a height of 60, 70, or 100 feet, and is covered with a tuft of fan-like leaves, usually about 18 feet in length and 14 feet in breadth. The leaves are used for covering houses, for making umbrellas and fans, and as a substitute for paper.

When the tree has attained its full growth, the flower spike bursts from its envelope or spathe with a loud report. The flower spike is then as white as ivory, and occasionally 30 feet long. When its fruit is matured, the tree generally dies.

TALISMAN (Gr. *telesma,* consecrated object). A figure cast or cut in metal or stone, and made, with certain superstitious ceremonies, at some particular moment of time, as when a certain star is at its culminating point, or when certain planets are in conjunction.

The talisman thus prepared was supposed to exercise extraordinary influences over the bearer, particularly in averting disease. In a more extensive sense the word is used, like amulet, to denote any object of nature or art, the presence of which checks the power of spirits or demons, and defends the wearer from their malice.

Relics, consecrated candles, rosaries, images of saints, etc. were employed as talismans in the Middle Ages; and at that time the knowledge of the virtues of talismans and amulets formed an important part of medical science.



Talipot Palm (*Corypha umbraculifĕra*)

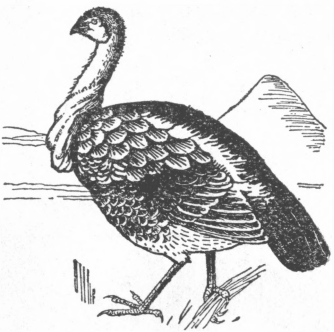
TALKING FILM (or **"TALKIE"**). Name given to motion pictures accompanied by sound, especially speech. Sound films owe their existence largely to modern electrical developments in the reproduction and amplification of sound. One method is to synchronise the motion picture with a separate sound record, but in the method now generally in use the sound is photographically recorded along the edge of the motion picture film. When the film is being projected, light is transmitted through this record on to a photo-electric

cell and transformed into a variable electric current, which is amplified and reproduced as sound by a loud speaker.

Talking pictures, which were first produced about 1928, have not only revolutionised film production and technique, but have greatly extended the range of motion pictures, while topically and historically they perform a great service by preserving both the image and the voice of famous persons. *See* CINEMATOGRAPHY.

TALLAGE. A tax levied by the Norman-English kings on towns and counties, as part of the revenues of the Crown, originally exacted probably in lieu of military service. It was abolished in 1340.

TALLEGALLA, or BRUSH TURKEY. A remarkable bird belonging to the order Grallatores, family Megapodiidæ, or mound-birds (*see* MEGAPODIUS). The *Catheturus lathămi* is the best-known species, and that usually designated by the distinctive name of "brush turkey." It inhabits Australia, where it is also known by the names "wattled tallegalla" and "New Holland vulture"—this latter name having reference to the naked vulturine head and neck.



Tallegalla—Brush Turkey

The male when full grown is coloured of a blackish-brown above and below, with greyish tints on the back. The head and neck are covered with very small feathers of blackish hue, whilst a large wattle, coloured bright or orange yellow, depends from the front of the neck. These birds are remarkable on account of the huge, conical "egg-mound" which they form, several of them jointly, for the purpose of therein depositing their eggs, which are greatly sought after on account of their delicious flavour.

TALLEYRAND-PÉRIGORD (tăl-ā-răn-pā-rĕ-gôr), **Charles Maurice de, Prince de Benevento.** French diplomat, born at Paris in 1754, died in 1838. Against his personal inclination he entered the priesthood, in which his birth and ability procured him rapid advancement, and in 1788 he was consecrated Bishop of Autun. On the meeting of the States-General he was elected Deputy for Autun. He sided with the popular leaders in the revolutionary movements; and his advocacy of the abolition of tithes and the transference of Church lands to the State gained him great popularity. In 1790 he was elected president of the National Assembly.

When the civil constitution of the clergy was adopted, he gave his adhesion to it, and ordained the first clergy on the new footing. For this he was excommunicated by a Papal brief, and thereupon renounced his episcopal functions (1791). In 1792 he was sent on a diplomatic mission to London, and while there was proscribed for alleged Royalist intrigues.

Forced to leave England (1794) by the provisions of the Alien Act, he sailed for the United States, but returned to France in 1796. The following year he was appointed Minister of Foreign Affairs; but, being suspected of keeping up an understanding with the agents of Louis XVIII., he was obliged to resign in July, 1799. He now devoted himself entirely to Bonaparte, whom he had early recognised as the master spirit of the time, and after Bonaparte's return from Egypt contributed greatly to the events of the 18th Brumaire (10th Nov., 1799), when the Directory fell and the Consulate began.

He was then reappointed Minister of Foreign Affairs, and for the next few years was the executant of all Bonaparte's diplomatic schemes. After the establishment of the Empire (1804) he became Grand-Chamberlain, and in 1806 was created Prince of Benevento.

After the Peace of Tilsit (1807) he broke with Napoleon, and (1808) secretly joined a Royalist committee. In 1814 he procured Napoleon's abdication, and afterwards furthered the restoration of Louis XVIII.

He took part in the Congress of Vienna, and in 1815, when the Allies again entered Paris, he became President of the Council with the portfolio of foreign affairs; but, as he objected to signing the second

Peace of Paris, he resigned and retired for fifteen years into private life. When the revolution of July, 1830, broke out, he advised Louis Philippe to place himself at its head and to accept the throne.

Declining the office of Minister of Foreign Affairs, he proceeded to London as Ambassador, and crowned his career by the formation of the Quadruple Alliance. He resigned in Nov., 1834, and quitted public life for ever.—BIBLIOGRAPHY: *Mémoires* (English translation by A. Hall); J. M'Cabe, *Talleyrand: a Biographical Study*; A. Pichot, *Souvenirs intimes de Talleyrand*.

TALLINN. Estonian name for Revel (q.v.).

TALLIS, Thomas. Author of some of the finest music in the cathedral service of the English Church, born about 1515, died in 1585. He served in the Chapel Royal during the reigns of Henry VIII., Edward VI., Mary, and Elizabeth.

TALLOW consists of the purified fat of oxen (beef tallow) and sheep (mutton tallow). It is a hard, colourless, or pale-yellow grease, almost odourless when fresh, but acquiring a disagreeable smell on exposure to air. It consists of about 75 per cent stearin and palmitin and 25 per cent olein. Mutton tallow melts at about 47° C., and beef tallow, a softer variety, at about 44° C.

The crude fat is first washed with water to remove blood and impurities, and then treated in a shredding apparatus to break up the cell walls which enclose the actual fat. The material is then "rendered" either by melting with direct heat or by means of steam.

In the first method the melting is carried out with constant stirring in an iron pan heated by an open fire. After standing for a short time the molten tallow is poured off from impurities, filtered, cooled to 35° C., and pressed. The residue consists of tallow, whilst the softer fat which is pressed out is known as oleomargarine, and is used for making butter substitutes. If the tallow is pressed at a still lower temperature, tallow oil, consisting mainly of olein, is obtained.

On the large scale the rendering is usually carried out in a closed boiler by means of steam at a pressure of about 1½ atmospheres, the melted fat being worked up as before; by this means a larger yield is obtained. Tallow is used as a lubricant, in the manufacture of soap (q.v.), and in leather dressing. It was largely used for the preparation of the old-fashioned tallow candles, but, owing to their objectionable smell, they have been superseded by stearin candles, which are made from the fatty acids derived from tallow.

TALLOW TREE (*Stillingia sebifera*). A tree of the nat. ord. Euphorbiaceæ, one of the largest, the most beautiful, and the most widely diffused of the plants found in China. From a remote period it has furnished the Chinese with the material out of which they make candles. The capsules and seeds are crushed together and boiled; the fatty matter is skimmed as it rises, and condenses on cooling.

The tallow tree has been introduced into the United States, and is almost naturalised in the maritime parts of Carolina. It has also been acclimatised by the French in Algeria. The tallow tree of Malabar is *Vateria indica*. *See* VATERIA.

TALLY. A wooden rod formerly much used as a method of keeping accounts. In the exchequer of England tallies were not abolished until 1782, but the Act which abolished them did not come into force until 1826. An exchequer tally was an account of a sum of money. The tally itself consisted of a wooden rod, having on one side notches, indicating the sum for which the tally was an acknowledgment, and on the two opposite sides the tallier's (i.e. modern teller) notes.

The rod was cleft longitudinally in such a manner that each piece retained one of the written sides, and one-half of every notch cut in the tally. One of these parts, the *counterstock*, was kept in the exchequer, and the other, the *stock*, only issued. When the part issued was returned to the exchequer (usually in payment of taxes), the two parts were compared, as a check against fraudulent imitation. The size of the notches made on the tallies varied with the amount. The notch for £100 was the breadth of a thumb, for £1 the breadth of a barleycorn. A penny was indicated by a slight slit.

TALLY SYSTEM. A mode of selling upon credit upon the instalment system, of which hire-purchase and the fixed instalment systems are outcomes. *See* HIRING.

TALMA, François Joseph. French tragedian, born 1763, died 1826. In 1787 he made his début at the Comédie Française as Séide in Voltaire's *Mahomet*. His greatest successes were achieved at the Théâtre de la République, which he and others founded in 1791. He enjoyed the intimacy of Napoleon, and was the

friend of Chénier, Danton, Camille Desmoulins, and other revolutionists. Talma was the greatest modern tragic actor of France, and one of the earliest advocates of realism in scenery and costume.

TALMUD, THE. The *Talmud* is a corpus of the sayings of the Jewish rabbis of the first six Christian centuries. In theory it is an elaboration of the Law of Moses, and Rabbi Akiba in the second century described it as "a hedge about the Law." It comes in result to be an intricate system of casuistry attempting to meet every possible case which might occur, and so it deals with every imaginable subject.

In spirit and subject-matter and method it is identical with the Muslim books of tradition of the tenth century. The word *talmud* is a Hebrew word meaning "learning" or "teaching." The *Talmud* is made up of two strata, the Mishnah or text, and the Gemara or commentary upon the Mishnah.

From the point of view of matter its contents are distinguished into Halakha, literally "procedure," the legal portions; the stories and all the rest being Haggada, "narrative." The rabbis whose sayings are recorded in the Mishnah are called Tannaim, "traditionists"; those who supply the material of the Gemara, Amoraim, "sayers." Sayings of the Tannaim which did not get into the Mishnah are called Baraita, "extras." They are found in the Gemara introduced by the words *tna Rabbanan*, "the rabbis hand down," or the like.

The Mishnah contains the teaching of the rabbis till about the year A.D. 200. It was collected by Rabbi Jehudah the Holy. Mishnah means "repetition," that is, of the Law. It is in the late Hebrew language. The Gemara, "completion," finishes about the year A.D. 600. Its language is Aramaic, and the later portions a mere jargon. The two together make up the *Talmud*. The plan is to give a few lines of Misnah, followed by the Gemara upon it, which extends to two or three pages. There are two recensions or editions of the *Talmud*, the *Babylonian*, and the *Palestinian* or *Jerusalem Talmud*. The latter is considerably the shorter.

The *Talmud* is divided into six "orders," Sedarim, whence the Jews call it Shas, from *shisshah sedarim*, "six sedarim." Each of these Seder (singular of Sedarim) contains from seven to twelve "tractates," Massekheth, sixty-three (originally sixty) in all. The Tractates are not always connected with the order under which they fall. The orders are: (1) Zeraim, "seeds," on agriculture and crops; (2) Moed, "feasts;" (3) Nashim, "women," on levirate, divorce, marriage; (4) Nezikin, "damages," on civil and criminal law; (5) Kodashim, "holy things," offerings and vows; (6) Teharoth, "cleansings," ceremonial ablution.

The following subjects are dealt with in the Tractates: under Order I., prayers, heave-offerings, tithes; under II., the Sabbath, the half-shekel tax; under III., vows, the law of the Nazarite; under IV., the Sanhedrin, idolatry, "sayings of the Fathers"; under V., the measurements of the Temple; under VI., leprosy, the red heifer, baths, sacred books. In the *Babylonian Talmud* at the end of Order IV. seven uncanonical Tractates are inserted, of which the most important are the sayings of Rabbi Nathan and Soferim ("scribes"). It was forbidden to write the Oral Law, and the whole of this mass of tradition was carried in the memory. Some, however, think it was written down almost at once.

The best known of the early rabbis are Hillel and Shammai, each of whom founded a school. Hillel's son, or grandson, Gamaliel was the teacher of St. Paul. After the fall of Jerusalem the rabbis removed to Jabneh. Here Eliezer ben Hyrcanos and Rabbi Akiba were chief disputants. The former was excommunicated; the latter died about A.D. 135 (in the war of Bar Cochba, whom he believed to be the Messiah).

Rabbi Tarphon may be the Tryphon of Justin Martyr. Rabbi Meir drew up a Mishnah, founded on one of Akiba, and itself the basis of that of Jehudah. Simeon ben Jochai was long believed to be the author of the *Zohar*. Rabbi Jehudah the Holy, or the Prince, is generally called simply Rabbi. These are all Tannaim.

BIBLIOGRAPHY: The *Babylonian Talmud* was printed for the first time in Vienna, 1520-3; the censored edition, Basel, 1578-81, omits passages offensive to Christians. Other editions followed, the last being that of L. Goldschmidt, Berlin, 1897 ff. There is an English translation by Rodkinson, Boston, 1901 ff. The Mishnah, text and Latin translation, was published by Surenhusius, Amsterdam, 1698-1703.

The last edition is that of Beer, Holtzmann, and others (text with vowels, translation, and notes), Giessen, 1912 ff. Separate Tractates have been edited (some with Gemara) or translated by De Sola and Raphall

(eighteen tractates), London, 1845; Strack (*Yoma*, etc., Berlin, 1888); Taylor, *Sayings of the Jewish Fathers*, Cambridge, 1897; Streane, *Chagigah*, Cambridge, 1891; Danby, *Sanhedrin*, London, 1919. The *Jerusalem Talmud*, first published in Vienna about 1523, has been translated into French by Schwab, Paris, 1871. The text of its Mishnah has been edited by Lowe, Cambridge, 1883. The best introduction to the *Talmud* is that of Strack, *Einleitung in den Talmud*, 5th edition, including Midrash, Leipzig, 1921.

TAMALE. The headquarters of the Chief Commissioner of the Northern Territories of the Gold Coast, West Africa. Pop. 12,941.

TAMAR. A river of England, flowing into Plymouth Sound by the estuary known as the Hamoaze.

TAMARICA'CEÆ. A small natural order of polypetalous dicotyledons. The species are either shrubs or herbs, inhabiting chiefly the basin of the Mediterranean. They have minute alternate simple leaves and usually small white or pink flowers in terminal spikes. They are all more or less astringent, and their ashes after burning are remarkable for possessing a large quantity of sulphate of soda. *See* TAMARISK.

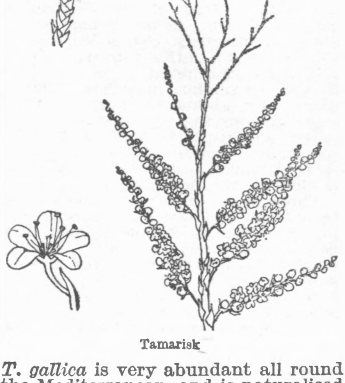
TAM'ARIN. The name of certain South American monkeys. The tamarins are active, restless, and irritable little creatures, two of the smallest being the silky tamarin (*Midas rosalia*) and the little lion monkey (*M. leonīnus*), the latter of which, though only a few inches in length, presents a wonderful resemblance to the lion.

TAM'ARIND (*Tamarindus indica*).

Tamarind

A large and beautiful tree of the East and West Indies, nat. ord. Leguminosæ. It is cultivated chiefly for the sake of its pods (tamarinds). The West Indian tamarinds are put into casks, with layers of sugar between them, or with boiling syrup poured over them, and are called prepared tamarinds. The East Indian tamarinds are preserved without sugar. They are dried in the sun, or artificially with salt added.

TAM'ARISK. The common name of shrubs of the genus Tamarix, the type of the nat. ord. Tamaricaceæ.



Tamarisk

T. gallica is very abundant all round the Mediterranean, and is naturalised on some parts of the south coast of England. It attains a height of from 16 to 20 feet, has small flowers of a bright-rose colour, and altogether has a very attractive appearance, which makes it very much sought after as an ornament for shrubberies and parks.

TAM'ATAVE. The chief port on the eastern side of Madagascar. Pop. 15,022.

TAMAULIPAS (tä-mou-lē'päs). A maritime state of Mexico, on the Gulf of Mexico, north of Vera Cruz; area, 30,831 sq. miles. The coast is low, but in the interior, towards the south, the surface becomes finely diversified by mountain, hill, and valley. The soil is generally fertile. Cattle in vast numbers are reared on the pastures. The foreign trade is carried on chiefly at the ports of Tampico and Matamoros. The capital is Ciudad Victoria. Pop. (1930), 343,677.

TAMBOURINE (tam-bu-rēn'). A musical instrument of the drum species, much used among the Spanish and Italian peasants as well as elsewhere. It consists of a piece of parchment stretched over the top

of a broad hoop, which is furnished with little bells. It is sounded by sliding the fingers along the parchment, or by striking it with the back of the hand or with the fist or the elbow.

TAMBOV. A former government of Russia; area, 25,710 sq. miles. Vast numbers of excellent horses, cattle, and sheep are reared. Industrial establishments include distilleries, tallow-melting works, sugar-works, and woollen-mills. Pop. 2,721,173.

TAMIL. One of the Dravidian languages, the name being sometimes erroneously extended to denominate the entire family. From a literary standpoint it is the chief of the Dravidian speeches, and is spoken by about seventeen million people occupying that region of the Indian Peninsula between Pulicat, a few miles north of Madras, and Cape Comorin, and between the Bay of Bengal and the Eastern Ghats.

Throughout Ceylon the coolies are Tamilians, and the Tamilians generally are the most enterprising and least scrupulous of all Hindus, settling in swarms wherever money is to be made. The *Klings* of the Straits Settlements, and the East generally, are Tamilians.

Malayâlam, spoken within a small area on the west (Malabar) coast of India, south of Mangolore, is very closely allied to Tamil. *Tulu* is used in and around Mangalore. *Kanarese* is used in Mysore and in the western region of Haidarabad.

TAMMANY HALL, New York, is the headquarters of a powerful section of the Democratic party. In 1789 William Mooney founded the Society of St. Tammany, a benevolent institution named after a well-known Delaware Indian chief. From this society sprang the Tammany Hall General Committee, which, though not representative of the best of the Democratic party, soon attained great power. Aaron Burr became a leading spirit, and secured the return of Jefferson as President of the United States.

In 1870 Tammany Hall fell under the evil sway of the notorious Tweed, an early Democratic "boss." Tweed initiated a daring system of plunder, which in two years trebled New York's city debt, and proceeded to levy blackmail on firms and citizens. At length Tweed fell, betrayed by a dissatisfied participant in the spoil; but Tammany flourished later under John Kelly and Richard Croker, and is still a byword of American political and civic corruption.

TAMMERFORS, or **TAMPERE.** The chief industrial town of Finland, 90 miles N.E. of Åbo. Pop. (1930), 55,967.

TAMMUZ. A proper name occurring in Scripture, but only once, in Ez. viii., 14, a deity of Sumerian origin, worshipped in Babylonia. Tammuz was known among the Canaanites as *Adoni*, and is considered as equivalent to the Greek *Adonis*. The chief worship of Adonis among the Phœnicians was at Byblus, whence it was carried to Cyprus and Greece. Adonis has also been identified with Osiris.

The death of Tammuz was celebrated by lamentations, his resurrection with frantic rejoicings mingled with the grossest debauchery. This idolatry appears to have been originally symbolical, connected with the death of nature in winter and its revival in spring.

TAMPA. A city of Florida, United States, the county seat of Hillsboro county, on a branch of the Tampa Bay inlet of the Gulf of Mexico; served by the Seaboard Air Line, etc. It is a seaport of importance, a jumping-off point for trade with the West Indies, and is also a seaside-resort. Pop. (1930), 101,161.

TAMPI'CO. A seaport-city of Tamaulipas state, Mexico, at the mouth of the Panuco. There are important exports. Pop. 76,000.

TAMSUI. A seaport of Formosa, 40 miles from Keelung.

TAMWORTH. A municipal borough and market town of England, partly in Warwickshire and partly in Staffordshire. Pop. (1931), 7510.

TANA. A river of Kenya Colony, rising in Mount Kenya. Length, 500 miles.

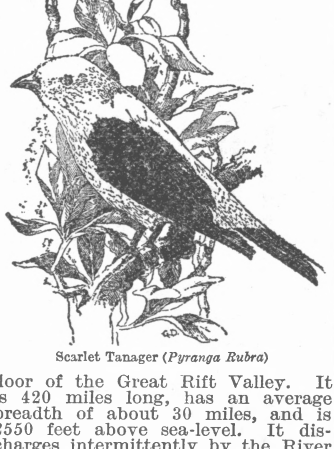
TAN'AGERS (Tanagridæ). An American family of perching birds, closely resembling finches, and generally brilliantly coloured. They are mostly natives of South America, but the scarlet tanager (*Pyranga rubra*) and summer red bird (*P. Æstiva*) range north to Canada.

TANCRED. Son of the Marquis Otho the Good and Emma, the sister of Robert Guiscard, born 1078, died 1112. He was one of the heroes of the First Crusade. He distinguished himself at the siege of Nicæa (1097), at the battle of Dorylæum (July, 1097), at the capture of Jerusalem (July, 1099), and at Ascalon (12th Aug.) and was appointed by Godfrey de Bouillon Prince of Galilee. He died of a wound received at Antioch.

TANGA. A seaport of Tanganyika

Territory, 77 miles from Mombasa. Pop. 11,000.

TANGANYI'KA. A lake of Central Africa, lying to the south of Lake Albert and occupying part of the



Scarlet Tanager (*Pyranga Rubra*)

floor of the Great Rift Valley. It is 420 miles long, has an average breadth of about 30 miles, and is 2550 feet above sea-level. It discharges intermittently by the River Lukuga into the Congo. Tanganyika was discovered by Speke and Burton in 1858.

TANGANYIKA TERRITORY. An East African mandatory territory, comprising portions of the former colony of German East Africa, administered by Great Britain under Article 23 of Part I, Treaty of Versailles.

Area and Population. The old divisions of Ruanda and Urundi in the extreme north-west, and the tiny region south of the Rovuma River centring on Kionga (the Kionga triangle) are incorporated in the Belgian Congo and Portuguese East Africa respectively. There are twenty-two districts in the territory, viz. Tanga, Pangani, Bagamoyo, Dar-es-Salaam, Rufiji (Utete), Kilwa, Lindi, Rungwe (Tukuyu), Ufipa (Kasanga), Ujiji (Kigoma), Bukoba, Mwanza, Arusha, Moshi, Usambara (Lusheto), Tabora, Kondoa-Irangi, Dodoma, Morogoro, Iringa, Mahenge. (Names in parentheses are district capitals, which, if not specified, are named the same as the respective districts.) Area, about 374,000 sq. miles (including 20,000 sq. miles water); pop. (1931), 5,030,857 (including 8217 white). *See* URUNDI AND RUANDA.

Physiography. There is a coastline of 500 miles between the Umba River (north) and the Rovuma. From the coastal plain the country rises to the plateau (about 4000 feet altitude) of the hinterland, and this plateau is cleft by the Great Rift Valley, and descends abruptly to the surface-level of Lakes Tanganyika (2590 feet) and Nyasa (1600 feet), which lie within it. The north-eastern corner of Lake Nyasa, part of Lake Tanganyika, and the southern portion of Lake Victoria are within the territory, which includes also Mount Kilimanjaro, Mount Meru (14,955 feet altitude), and the Livingstone Mountains. Rivers are numerous.

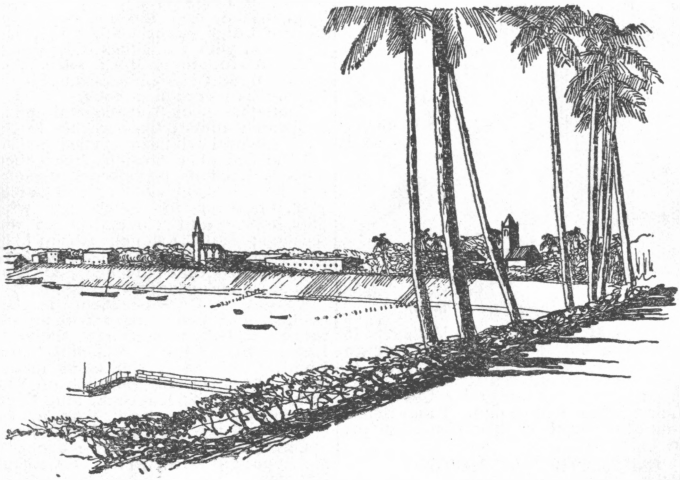
Climate. On the coastal plain the mean annual temperature is 78° F. Several climatic types exist: (1) the Indian, hottest in November, with a December-April wet season; (2) the monsoon type in the north-east, hottest in February, with March-May and November as wet seasons; and (3) the equatorial type prevalent in the north-west, with October-May and November-April as wet seasons, according to locality.

Towns. Dar-es-Salaam is the capital, and Tanga second in importance. Other seaports include: Bagamoyo, Kilwa, Pangani, and Lindi. Tabora is the chief inland town. Mwanza and Bukoba, on Victoria; Kigoma, Kasanga, and Ujiji, on Tanganyika; and Mwaya, on Nyasa, are the chief lake-side towns.

Communications. There are two metre-gauge railways: (1) Central Railway, from Dar-es-Salaam to Kigoma (Lake Tanganyika), length, 772 miles, with a branch line of 235 miles from Tabora to Mwanza; another branch line (93 miles) is being constructed from Manyoni to Kinyangiri. (2) Tanga Railway, from Tanga to Arusha via Moshi; length, 272 miles, with an extension to Kahe affording communication with the Uganda Railway at Voi (Kenya Colony). Motor roads are few. Steamers ply on the three great lakes.

People. The Swahili is the most important native race; it is mainly Bantu, although there are Masai in the north and people of Zulu descent in the south. On the coastal plain there are some 250,000 Mahommedans, but otherwise paganism is universal. About 10,000 Indians, 4000 Arabs, and 8217 Europeans compose the exotic element. Educational reconstruction began in 1919, and there are about ninety-nine Government schools. Protestant and Roman Catholic missionaries are at work. The Indian rupee, formerly legal tender, has been demonetised, and a new currency of shillings (20 = £1) has been adopted.

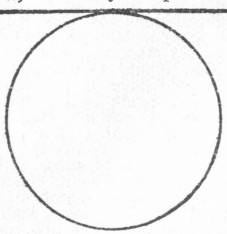
Production. Sisal, cotton, hides and skins, coffee, copra, ground-nut, ghee, grain, sesame, and bees-wax are the chief exports. Vast plantations of Ceara rubber have failed. In the forests of the Lake Victoria littoral and elsewhere the cedar, ebony, bamboo, etc., are found. Of known minerals, mica has been exploited; gold, coal, iron, lead, copper, salt, and gems (agate, tourmaline, etc.) are known to exist. Cattle, sheep and goats are raised in large numbers.



Tanganyika (View of Dar-es-Salaam)

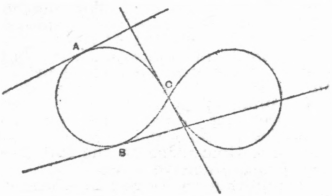
Government, etc. Tanganyika Territory was conquered by British arms during the European War (q.v.: *War in Germany's Colonies*, with map of German East Africa). A provisional civil administration (British) was established north of the Central Railway on 1st Jan., 1917, and was extended in March, 1918, as far south as the Rovuma River. The *Tanganyika* Order-in-Council was proclaimed at Dar-es-Salaam on 25th Sept., 1920, and a Governor with a nominated Executive Council now administers the Territory. In 1926 a Native Affairs Department was set up.

TANGENT. In geometry, a straight line which *touches* a curve. If the curve is a circle or a conic, a sufficient definition (Euclid's) is that a tangent is a line which meets the curve, but being produced does not cut it. The tangent to a circle or conic at a given point may therefore be described as the line which passes through the point and has the same direction as the curve at the point; and it is this property, stated in more precise form, which is taken as the general definition applicable to all curves. The straight lines shown in the figure are the tangents to the figure of eight at A, B, and C respectively; but the tangent at A is the only one of the three which satisfies Euclid's definition. The modern definition of a tangent involves the conception of a *limit*, and may be put briefly as follows. Let P be a point on a curve; take Q any neighbouring point, and join PQ, producing it indefinitely; the line PQ is called a *secant* through P. If the point Q is brought closer and closer to P, so that the distance PQ tends to zero (becomes indefi-



Tangent

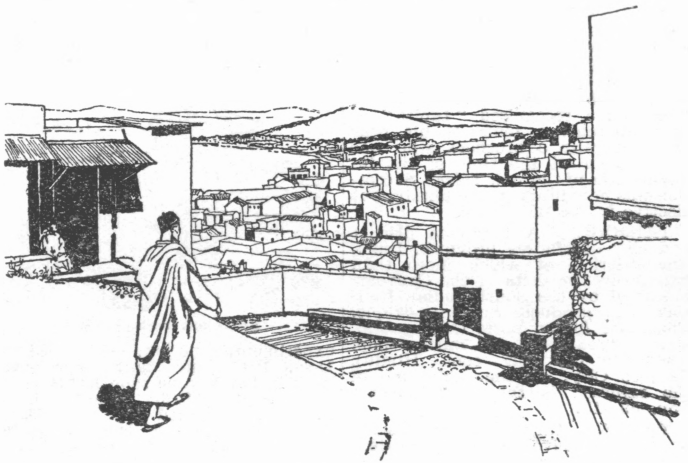
nitely small), the secant PQ may tend to a *limiting position*, in which case this limiting position is defined to be the tangent at P. If the curve



is defined analytically its equation being $y = f(x)$, the definition leads to the result that the gradient of the tangent at (x, y) is dy/dx, or $f'(x)$ (*see* CALCULUS). A curve may have an infinite number of maxima and minima near a particular point, and have no definite tangent at that oint; an example is the curve $= x^2\sin(1/x)$, at the origin. There re even continuous curves which ave no tangent anywhere, being, s it were, like the edge of a saw ith infinitely many infinitely short eth; an example is a curve defined nalytically by Weierstrass (*see* FUNCON). In geometry of three dimenons, a surface has not only tangent nes, but also *tangent planes*, the ngent plane at an ordinary point a surface being a plane containing l the tangent lines at that point.

TANGHIN (*Tanghinia venenifera*). A tree of Madagascar, nat. ord. Apocynaceæ, bearing a fruit the kernel of which, about the size of an almond, is highly poisonous. Trial by tanghin was formerly used in Madagascar as a test of the guilt or innocence of a suspected criminal. The person undergoing the ordeal was required to swallow a small portion of the kernel. If his stomach rejected it he was deemed innocent, but if he died, as happened in most cases, he was deemed to have deserved his fate and to have suffered the punishment of his crime.

TANGIER. A seaport and health resort of Morocco, on the Strait of Gibraltar, 39 miles south-west of Gibraltar. There is excellent anchorage in the bay, and carpets, dates, wax, etc., are exported. Pop. 51,000 (11,000 being Europeans). In 1662 Tangier was annexed to the English Crown, but in 1684 it was given up and became a pirate stronghold. By the Franco-Spanish Treaty of Madrid (1912) the Tangier Zone (140 sq. miles) was created. This by the Tangier Convention (Britain, France, and Spain) in 1923 became an international zone, and permanent neutrality was guaranteed. There is a consular Committee of Control, and an International Legislative Assembly (60 per cent native). In 1928 Italy became a contracting party to the Tangier Convention, and Spain received additional guar-



View of Tangier

antees for the security of her zone.

TANGLE. The common name of two species of sea-weed found on

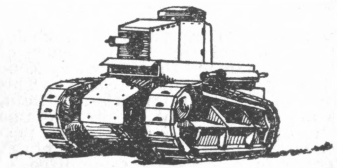
Tangle (Sea-weed)

the shores of Britain, *Laminaria digitāta* and *L. saccharīna*.

TANISTRY. A system of succession employed in early Ireland and Scotland by which every chief or king had a recognised "tanist" or heir-apparent, a male of his near kin (generally a brother), who was elected heir at the time of the inauguration of the new ruler. Succession was hereditary in the family, but elective in the individual.

TANJORE. A maritime district and city of Madras province, India. The district, of which more than half forms the delta of the Cauvery, is served by the South Indian Railway, and produces rice as a staple. There are fifteen ports (Negapatam, etc.). Area, 3727 sq. miles; pop. 2,363,000 (91 per cent Hindu). Tanjore City, on the main line of the railway, is the head-quarters. Pop. 59,913.

TANKS. Tanks are the essence of the offensive spirit in modern mechanical warfare, a single tank



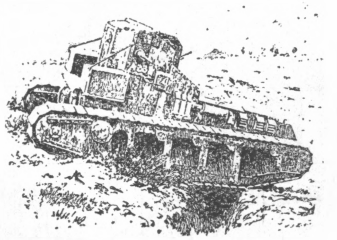
Tank (Latest type)

being in itself a heavily armoured weapon combining mobility with great offensive power. The tank is a great man-power saver, in that a single machine with its crew of from three to eight has the offensive power of many times those numbers of unarmoured infantry soldiers. A well-known writer on tanks, and one with great experience of his subject, sums up the question of the tactical employment of tanks in these three words: "penetration with security." In other words, tanks are used to assist infantry to reach the objective by breaking down the physical obstacles to their doing so, while at the same time using to the full their own great offensive power.

In addition to its rôle of an offensive weapon, the latest pattern of heavy tank of which details have been published can carry from twenty to twenty-five infantry soldiers in addition to its crew; and specially constructed tanks are in use as gun- or supply-carriers.

In the first case a 6-inch gun with its ammunition can be carried across country, and in the second case 10 tons of supplies.

The name tank as applied to these machines was, owing to the necessity of camouflage during the



British tank crossing a trench

experimental period, first used in Dec., 1915, and tanks were first used in battle nine months later, on 15th Sept., 1916, when, out of forty-nine detailed for the attack thirty-two reached their starting-points. Marvellous as has been their development, tanks are still very much in the experimental stage.

From the original Mark I. of 1915-6 to Mark V. Star of 1918, the latest one to be used in battle, is a far cry, and it is understood that later patterns are still more effective. The original Mark I. was fitted with a cumbersome and vulnerable tail as an aid to steering and balancing, both of which operations were performed with difficulty; succeeding Marks have had no tails, and their mechanism has been so much improved that they can turn almost as easily as a light car.

Infantry Training 1921 notes that 'the speed and radius of action of tanks are constantly increasing." This being so, it is reasonable to assume that the models later than those therein mentioned are possessed of much greater capabilities.

The present Mark V., a heavy tank, has a speed of 2½ miles an hour, is armed with two 6-pounders and three Hotchkiss guns, and can cross a 10-foot gap or surmount a parapet 4 feet 6 inches high; it has a crew of eight. Medium C Tank has three Hotchkiss guns, and a speed of 5 miles an hour; it also can negotiate a 10-foot gap, but its climbing powers are limited to a parapet of 3 feet 9 inches; it has a crew of three.

Medium D has a very much increased speed, even reaching to 20 miles an hour, and has an armament of one 6-pounder and three Hotchkiss guns. Improvements are constantly being made in tank design.—BIBLIOGRAPHY: C. and A. Williams-Ellis, *The Tank Corps*; Colonel J. F. C. Fuller, *Tanks in the Great War*.

TANNAHILL, Robert. A popular writer of Scottish songs, born in Paisley in 1774, of parents in humble life, and was himself bred to the occupation of a weaver. In 1807 the first edition of his *Poems and Songs* was published, and was received very favourably by the public. A second edition, carefully revised, which he had prepared for the press, was refused by Constable of Edinburgh, and this tended to increase the melancholy from which he had been suffering; on the 17th of May, 1810, he committed suicide by drowning. Among his songs are: *Gloomy Winter's Noo Awa'*; *Jessie, the Flower o' Dunblane*; *Loudon's Bonnie Woods and Braes*; and *The Lass o' Arranteenie*.

TANNENBERG. *See* EUROPEAN WAR (*Eastern Front, 1914*).

TANNHÄUSER (tân'hoi-zĕr), or **TANHÄUSER.** The hero of an old German legend. He gained admission into a hill called the Venusberg, in the interior of which Venus reigned, and for a long time he remained buried in sensual pleasures. Eventually he escaped and journeyed to Rome, but Pope Urban IV. refused to grant him pardon until the staff in his hand should sprout. Despairing, the knight returned to the Venusberg; but meanwhile the Pope's wand actually began to sprout, and, taking this as a sign from God, the Pope hastily sent messengers into all lands to seek for him. But Tannhäuser was never again seen.

The Tannhäuser legend has been treated poetically by Tieck and Heine, and Richard Wagner adopted it (with modifications) as the subject of one of his operas. (Cf. also Swinburne's *Laus Veneris*.) The Tannhäuser of the legend was identified with a German knight and minnesinger who lived in the thirteenth century.—Cf. Sabine Baring-Gould, *Curious Myths of the Middle Ages*.

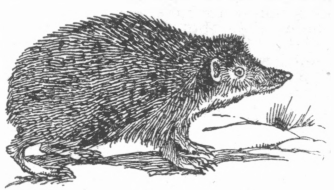
TANNIC ACID, or **TANNIN.** A peculiar acid which exists in every part of all species of oaks, especially in the bark, but is found in greatest quantity in gall-nuts. Tannic acid, when pure, is nearly white, and not at all crystalline. It is very soluble in water, and has a most astringent taste, without bitterness.

It derives its name from its property of combining with the skins of animals and converting them into leather, or tanning them. It is the active principle in almost all astringent vegetables, and is used in medicine in preference to mineral astringents, because free from irritant and poisonous action.

The name is generally applied to a mixture of several substances occurring in plants. All have a characteristic astringent taste, give a blue or green coloration with ferric salts, are precipitated by albumen or gelatine, and react with skin to give leather.

TANNING. *See* LEATHER.

TANREC, or **TENREC** (Centētes). A genus of insectivorous mammals covered with bristles about an inch



Tanrec

in length. They are the type of a special family (Centetidæ) only represented in Madagascar. They hibernate like the European hedgehogs, and live in burrows, which they excavate by means of their strong claws.

TANSY (*Tanacētum vulgāre*). A well-known plant, being abundant in Britain and throughout Europe on the borders of fields and roadsides. It is a tall plant, with divided leaves and button-like heads of

yellow flowers. Every part of the plant is bitter, and it is regarded as tonic and anthelmintic, tansy-tea being an old popular medicine. It is now cultivated in gardens

Tansy

mainly for the young leaves, which are shredded down and employed to flavour puddings, cakes, etc.

TANTA. A town of Lower Egypt. Tanta has three great annual fairs (January, April, and August). Pop. (1927), 90,016.

TAN'TALITE. A heavy mineral tantalate of iron and manganese resembling columbite (q.v.), and used as an ore of tantalum.

TAN'TALUM. A rare metallic element discovered in the Swedish minerals tantalite and yttrotantalite; chemical symbol, Ta; atomic weight, 181·5. It was long believed to be identical with *niobium*, but their separate identity has been established.

TAN'TALUS. In Greek mythology, a son of Zeus, and King of Phrygia, Lydia, Argos or Corinth, who was admitted to the table of the gods, but who had forfeited their favour either by betraying their secrets, stealing ambrosia from heaven, or presenting to them his murdered son Pelops as food.

His punishment consisted in being placed in a lake whose waters receded from his lips when he attempted to drink, and of being tempted by delicious fruit overhead which withdrew when he attempted to eat. Moreover, a huge rock for ever threatened to fall and crush him.

TANTALUS. A genus of wading birds of the stork family (Ciconiidæ). *T. loculator* is the wood-ibis of America, which frequents extensive swamps, where it feeds on serpents, young alligators, frogs, and other reptiles. The African tantalus (*T. ibis*) was long regarded as the ancient Egyptian ibis, but it is rare in Egypt, belonging chiefly to Senegal, and is much larger than the true ibis. Other species are native to South and South-East Asia.

TANTRAS. Sacred books of the Hindus, related to the *Puranas*. They are believed to have been composed in the sixth or seventh century, and are attributed to Dattatreya, who was the incarnation of the Hindu trinity, Brahma, Vishnu, and Siva. The teaching of the *Tantras* is usually in the form of a dialogue between Siva and Durga. The *Tantras* are magical and mystical in their contents, but discuss a variety of subjects, dealing with the creation and destruction of the world, and the worship of the gods.

TAOISM. One of the three "Teachings," or doctrinal systems of China, ascribed to Lao-Tse (q.v.). The source of this philosophical and politico-ethical system is the *Tao-tih-king*, supposed to have been written by Lao-Tse. Taoism teaches a philosophy of the unconscious, self abnegation and disinterestedness, cultivation of humility and quietism, avoidance of self-display, and non-interference with the natural order of things.

Politically it preaches a theory of *laisser-faire*. The chief exponents of Taoism were Chwang-tse in the fourth, and Lieh-tse in the third century B.C. Present-day Taoism, however, differs widely from the teaching of the *Tao-tih-king*. It is a mass of magic and superstition. Between the third and sixth centuries Taoism was greatly influenced by Buddhism.—BIBLIOGRAPHY: J. Legge, *Religions of China*; R. K. Douglas, *Confucianism and Taouism*.

TAORMI'NA. A famous modern winter seaside-resort, in the province of Messina, Sicily. Pop. 5000.

TA'PESTRY. A decorated stuff used chiefly for curtains, wall hangings, and furniture coverings, made by weaving coloured threads into warp threads without a loom or shuttle. The warp threads may either be stretched in vertical frames (high warp or *haute lisse*, the method of the Gobelins factory) or in horizontal frames (low warp or *basse lisse*, the method used at Beauvais). In both cases the weaver works from a design known as a *cartoon*, and a similar result is obtained.

The process was practised at a

very early period. Examples survive from ancient Egypt and Greece, also numerous specimens of Egypto-Roman work of the second to the fifth century A.D.; and to-day it is widespread in primitive societies.

From the fifth to the ninth century the Roman tradition was mainly preserved in the monasteries; but guilds of weavers appeared later, and the art became important and widespread by the end of the thirteenth century. Its chief centres were in Northern Europe, notably at Arras in the fourteenth and fifteenth centuries, Brussels in the fifteenth and sixteenth centuries, Middelburg and Delft in the late sixteenth and early seventeenth centuries, Mortlake in the seventeenth century, and Paris from the sixteenth century to the present day.

Climate there made tapestry more suitable for the decoration of ecclesiastical and civil buildings and of private houses than the wall paintings of Italy and the south. Liberal encouragement and patronage were given by the rulers of different countries.

Cosimo I. of Florence established a factory in that city which survived till the eighteenth century; Wolsey and Henry VIII. bought the finest Flemish tapestry of their day, of which many examples still remain at Hampton Court; in France, Francis I., Henry II., and Henry IV. all established factories, and Louis XIV. founded those of Beauvais and Gobelins, which are still in operation; and in England, James I. and Charles I. gave liberal support to the Mortlake factory.

Private enterprise in the eighteenth and nineteenth centuries is represented by the existing factory at Aubusson, and the work in England of Hickes, of the Fulham factory, and of William Morris.

The cartoons of the earlier tapestry weavers were mainly derived from mural decorations and illuminated manuscripts, and in subject and design show markedly the influence of painting. In the fifteenth and sixteenth centuries, however, more purely decorative pieces are woven, such as the leafy designs known as *verdures*, and those embodying heraldic or pure abstract ornament.

The borders enclosing the designs also show an interesting development, from a simple selvage or plain band, through narrow borders enclosing legends in Gothic letter, or composed of floral patterns, to the heavy and elaborate ornament of the seventeenth and eighteenth centuries.

Among painters who have supplied designs for tapestry are: Jehan Fouquet (a set illustrating the Trojan War, woven at Arras in the fifteenth century, represented in the Victoria and Albert Museum), Raphael (the famous cartoons of the *Acts of the Apostles*, in the Victoria and Albert Museum), Rubens, Bernard van Orley, Le Brun, Boucher, and Oudry.

With the change in painting from the use of colour in a mosaic of definite tints, to its treatment as modified by light and shade and atmosphere, corresponds the more realistic treatment of the seventeenth century and subsequent tapestries, in which there is not only a much wider range of colour but greater complexity and subtlety in weaving.

This approximation of tapestry and painting culminates in the productions of Gobelins and Beauvais under the control of the painters Oudry and Boucher, the former factory concentrating mainly on wall hangings, the latter on furniture coverings, screens, and small panels. The result has been virtually to kill tapestry as an independent art, by causing it to lose its own characteristic qualities in attempting to imitate and rival painting.—Cf. W. G. Thomson, *A History of Tapestry*.

TAP'ETI. The Brazilian hare, the *Lepus brasiliensis*, the only hare inhabiting South America.

TAPE-WORMS. The name common to certain internal parasites, constituting the class Cestoda of the phylum Platyhelmia, found in the mature state in the alimentary canal of warm-blooded vertebrates. Tape-worms are composed of a number of flattened joints (proglottides), attached to a head (which is the true animal) furnished with hooks or suckers, or both, which enable it to maintain its hold on the mucous membrane of the intestines of its host. The proglottides form a chain of bisexual buds, the oldest being farthest removed from it.

The tape-worm has neither mouth nor digestive organs, nutrition being effected by absorption through the skin. The length of the animal varies from a few inches to several yards. The ova do not undergo development in the animal in which the adult exists. They require to be swallowed by some other form, usually a warm-blooded vertebrate, the ripe proglottides being expelled from the bowel of the host with all their contained ova fertilised. The segments or proglottides decompose and liberate the ova, which are covered with a capsule.

After being swallowed the capsule

bursts and an embyro, called a *proscolex*, is liberated. This embryo, by means of spines, perforates the tissues of some contiguous organ, or of a blood-vessel, in the latter case being carried by the blood to some solid part of the body, as the liver or brain, where it surrounds itself with a cyst, and develops a vesicle containing a fluid. It is now called a bladder-worm, which is incapable of further development till swallowed by the second or intermediate host. Here it becomes the head of the true tape-worm, from which proglottides are developed posteriorly by gemmation, and we have the adult animal with which the cycle begins.

Several true tape-worms occur in man, *Tænia solium*, the cystic form of which (*Cysticercus cellulosæ*) produces the measles of the pig, being the most common. Another, *T. mediocanellata*, is developed from the bladder-worm, which causes measles in the ox. The tape-worm of the dog *T. serrāta*, is the adult form of the large bladder-worm (*Cœnurus cerebralis*) which infests the brain of the sheep, causing staggers. Each cyst produces a number of tape-worms. *T. echinococcus* of the dog passes its bladder-worm stage in man, or a hoofed mammal, as a huge compound cyst (*Echinococcus veterinorum*), from which numerous tape-worms may develop.

TAPHRINA. A genus of ascomycetous Fungi, family Exoascaceæ. They are parasites producing blister-like malformations on the leaves of pear, poplar, elm, and other trees.

TAPIO'CA. A farinaceous substance prepared from cassava meal, which, while moist or damp, has been heated for the purpose of drying it on hot plates. By this treatment the starch-grains swell, many of them burst, and the whole agglomerates in small irregular masses or lumps. In boiling water it swells up and forms a viscous jelly-like mass. *See* CASSAVA.

TAPIR. The name of odd-toed ungulate or hoofed mammals forming the family Tapiridæ. The nose resembles a short fleshy proboscis; there are four toes to the fore-feet, and three to the hind ones. The common South American tapir (*Tapirus terrestris*) is the size of a small ass, with a brown skin, nearly naked. It inhabits forests, lives much in the water, conceals itself during the day, and feeds on vegetable substances. There are several other American species.

The *T. indicus* is found in the forests of the Malay Peninsula, Java, and Sumatra. It is larger than the American species, and is a most conspicuous animal from the white back, rump, and belly contrasting so strongly with the deep sooty black of the rest of the body as, at

Tapir (*Tapirus indicus*)

a little distance, to give it the aspect of being muffled up in a white sheet. The young are spotted. Fossil tapirs are scattered throughout Europe, Asia, and North America.

TAPLOW. Village of Buckinghamshire. It is on the Thames, 4 miles from Slough, on the G.W. Rly. There is an interesting old church, and here is **Taplow Court**, the residence of Lord Desborough. The village is visited for boating.

TAPPING, or **PARACENTE'SIS.** A surgical operation commonly performed for dropsy, but also for empyema, and for the relief of other morbid effusions in natural or accidental cavities of the body. It consists in piercing the wall of the cavity with an instrument, commonly a trocar or a bistoury. The fluid usually flows out, but it is sometimes necessary to use an instrument which acts as a syringe.

TAR. *See* COAL-TAR; GAS MANUFACTURE; PITCH; RETORT; WOOD-TAR.

TARA, or **TARO.** The native name given to plants of the genus Colocasia, nat. ord. Araceæ, especially *C. esculenta* and *C. macrorhiza*, cultivated in the Pacific Islands for their esculent root, which, though pungent and acrid when raw, becomes palatable when cooked. A pleasant flour is also made of the roots or tubers, and the leaves are used as spinach. The name is also given to the allied *Caladium esculenta*, whose tuberous root and leaves are used in the same manner.

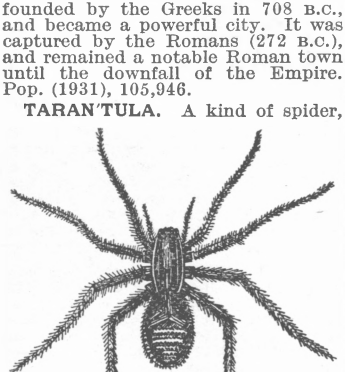
TARA. A hill (510 feet altitude) of County Meath, Irish Free State, the centre of Druidism in the time of St. Patrick, and for long a residence of the kings of Ireland.

TARAI (ta-rī′; "moist land"). A marshy and jungly tract of Northern India, running along the foot of the first range of the Himalayas for several hundred miles, with a breadth of from 2 to 15 miles. The name is officially applied to a district in the Kumaun division of the United Provinces, consisting of a strip of country of about 90 miles in length along the foot of the Himalayas, and about 12 miles in breadth; now comprised in the Naini Tal district. Both are malarial and frequented by big game.

TARANA′KI (formerly **New Plymouth**). A provincial district of New Zealand, on the west coast of North Island; area, 3750 sq. miles. It is dominated by Mount Egmont, an extinct volcano. Dairying is the chief industry. New Plymouth is the chief town and port. Pop. (1932), 72,600.

TARAN′TO (ancient **Tarentum**). A seaport of Apulia, South Italy, in the province of Lecce, on the Gulf of Taranto. Manufactures include linen, cotton, velvet, muslin, and gloves. Taranto is a station of the Italian navy, and has an arsenal, etc. The ancient *Tarentum* was founded by the Greeks in 708 B.C., and became a powerful city. It was captured by the Romans (272 B.C.), and remained a notable Roman town until the downfall of the Empire. Pop. (1931), 105,946.

TARAN′TULA. A kind of spider,



Tarantula (*Lycōsa tarantŭla*)

the *Lycōsa tarantŭla*, found in some of the warmer parts of Italy. When full grown it is about the size of a chestnut, and is of a brown colour. Its bite was at one time supposed to be dangerous, and to cause a kind of dancing disease; it is now known not to be worse than the sting of a common wasp.

TARAPACÁ. A maritime province of Northern Chile. It forms a part of the rainless desert which produces nitrate of soda and some silver. Iquique is the seaport-capital; other ports are Pisagua and Patillos. Area, 21,252 sq. miles; pop. (1930), 113,331.

TARARE (tà-răr). A town of France, in the department of Rhône. Pop. 13,000.

TARASCON. A town of Southern France, in the department of Bouches-du-Rhône, on the Rhône. The placidity of its daily routine is satirised by Daudet (*Tartarin de Tarascon*). Pop. 8478.

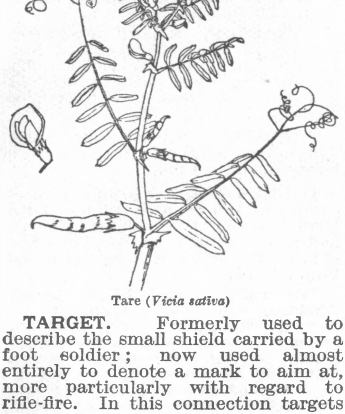
TARBERT. A fishing port, Argyllshire, Scotland, in the north of Kintyre. Pop. 1983.

TARBES (tårb). A town of France, capital of the department of Hautes Pyrénées, on the Adour. Manufactures embrace leather, woollens, etc., and a breed of horses is raised. Pop. 33,374.

TARDIEU, André Pierre Gabriel Amédée. French statesman. He was born in Paris, 22nd Sept., 1876, and educated there. After a journalistic career, during which he was foreign editor of *Le Temps*, he entered the Chamber of Deputies in 1914, and was High Commissioner of France to the United States, 1917-9. He was a French delegate to the Peace Conference, 1918-9. An adherent of Clemenceau, he firmly opposed any version of the Versailles Treaty. He became Prime Minister in 1929, in 1930, and again on the fall of the Laval Government, 21st Feb., 1932. He resigned, 10th May, on the election of a new President, following the adverse result of a general election.

TARE. The common name of different species of Vicia, a genus of leguminous plants, known also by the name of *vetch*. There are numerous species and varieties of tares or vetches, but that which is found best adapted for agricultural purposes is the common tare (*Vicia sativa*), of which there are two principal varieties, the summer and winter tare. They afford excellent food for horses and cattle, and hence are extensively cultivated throughout Europe. (*See* VETCH.) The *tare* mentioned in Scripture (Matt. xiii., 36) is supposed to be the *Lolium temulentum* or darnel (q.v.).

TARE. In commerce, a deduction made from the gross weight of goods as equivalent to the real or approximate weight of the cask, box, bag, or other package containing them. Tare is said to be *real* when the true weight of the package is known and allowed for, *average* when it is estimated from similar known cases, and *customary* when a uniform rate is deducted. In the phrase *tare and tret*, the word *tret* signifies an allowance for waste.



Tare (*Vicia sativa*)

TARGET. Formerly used to describe the small shield carried by a foot soldier; now used almost entirely to denote a mark to aim at, more particularly with regard to rifle-fire. In this connection targets

Target. First-class Figure Target

are of many kinds, shapes, and sizes, though the basic construction of all is the same, i.e. all are made of a framework of wood, over which is stretched a sheet of canvas, on which is painted either a "bull's-eye" or other mark to aim at, the remaining space being divided by invisible concentric circles, hits in which count less than in the bull's-eye; other targets have figures representing a man in various positions.

TÂRGU JIU (töirgu zhyu). A town of Wallachia, Rumania, capital of the department of Gorjiu, on the Jiu, one of the chief Wallachian rivers; the terminus of the State railway from Filiasi. Standing at the entrance to the gorge of the Jiu, the town owes its importance to its position at the head of a route across the Transylvanian Alps, and as such it figured prominently during the European War.

The Rumanians were driven out of Târgu Jiu on 15th Nov., 1915, after a struggle lasting from 23rd Oct. almost without cessation, during the first phase of which the Germans under Falkenhayn were driven back in utter disorder, and were pursued until 1st Nov. The second phase began on 10th Nov. Dragalina, the Rumanian general, was killed during the first battle.

TARGUM (Aram. *targum*, translation, from *targem*, to interpret). A version of the Hebrew Scriptures in the Aramaic language, which became necessary after the Babylonian captivity, when Hebrew began to die out as the popular language. An official, called *meturgeman*, had to translate the Hebrew Scriptures in the synagogues, and these translations were afterwards called *Targum*.

The *Targum*, long preserved by oral transmission, does not seem to have been committed to writing until the first centuries of the Christian era. The most ancient and valuable of the extant *Targums* are those ascribed to or called after Onkelos (q.v.) and Jonathan Ben Uzziel. All the *Targums* taken together form a paraphrase of the whole of the Old Testament, except Nehemiah, Ezra, and Daniel.

TARI'FA. A seaport of Andalusia, Spain, in the province of Cadiz, the most southerly town in Europe. It is quandrangular in build, and protected by a fortified islet. Fishing is the staple industry. Tarifa oranges are noted for their sweetness. Pop. 12,500.

TARIFF REFORM. *See* FREE TRADE; PROTECTION.

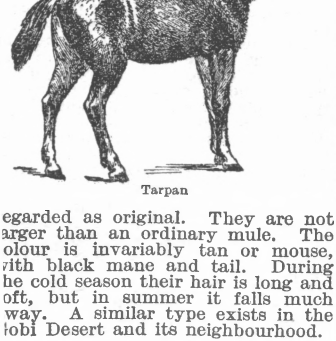
TARN. A department of South-Western France; area, 2231 sq. miles. Cereals and vines are cultivated on the tops and sides of the flat-topped hills. The capital is Albi. Pop. (1931), 302,994.

TARN-ET-GARONNE. A department of South-Western France; area, 1440 sq. miles. It belongs to the basin of the Garonne, which traverses it south to north-west, and receives within it the accumulated waters of the Tarn (length, 230 miles) and Aveyron. Wheat and other cereals, fruit, etc., are raised. Woollen cloth and serge, linen goods, silk hosiery, cutlery, leather, etc., are made. Montauban is the capital. Pop. (1931), 164,259.

TARNOPOL'. A town of Poland, in Galicia, on the Sereth. The inhabitants are employed in corn-milling and trading in agricultural produce. Pop. 31,000.

TARNOW. A town of Poland, in Galicia, on the Biala. It has manufactures of linen, leather, chicory, and glass. Pop. 36,000.

TARPAN. The wild horse once abundant in the steppe region between the Dnieper and Caspian, belonging to one of those races which are by some authorities



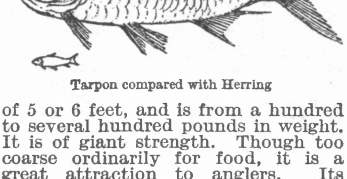
Tarpan

egarded as original. They are not arger than an ordinary mule. The olour is invariably tan or mouse, ith black mane and tail. During he cold season their hair is long and oft, but in summer it falls much way. A similar type exists in the obi Desert and its neighbourhood.

TARPAU'LIN. Canvas well coated ith tar, and used to cover the atchways, boats, etc., on ship-oard, and also to protect agricul-ral produce, goods in transit, etc., om the effects of the weather. In odern times so-called tarpaulin-oth is extensively made from jute arns, and delivered untarred to) used for the above-mentioned rposes.

TARPEIAN ROCK. A precipitous ck forming part of the Capitoline ill at Rome over which persons nvicted of treason to the State were hurled. It was so named, according to tradition, from *Tarpeia*, a vestal virgin of Rome, and daughter of the governor of the citadel on the Capitoline, who, covetous of the golden bracelets worn by the Sabine soldiery, opened the gate to them on the promise of receiving what they wore on their left arms. Once inside the gate they threw their shields upon her, instead of the bracelets. She was buried at the base of the Tarpeian Rock.

TARPON, or TARPUM. The *Megalops atlanticus*, a herring-shaped fish found on the southern coasts of the United States and in the West Indies. It reaches a length



Tarpon compared with Herring

of 5 or 6 feet, and is from a hundred to several hundred pounds in weight. It is of giant strength. Though too coarse ordinarily for food, it is a great attraction to anglers. Its scales, which are of great size, are largely used in ornamental work.

TARQUINIUS, Lucius, surnamed *Priscus* (the first or the elder). In Roman tradition the fifth King of Rome, supposed to have reigned from 616-578 B.C. The family of Tarquinius was said to have been of Greek extraction, his father, Demaratus, being a Corinthian who settled in Tarquinii, one of the chief cities of Etruria. Having removed with a large following to Rome, Tarquinius became the favourite and confidant of the Roman king, Ancus Martius, and at his death was unanimously elected his successor.

According to Livy, he made war with success on the Latins and Sabines, from whom he took numerous towns. His reign was distinguished by the construction of the Cloaca Maxima, the Forum, the wall round the city, and the Capitoline Temple. He was killed by assassins employed by the sons of Ancus Martius in 578 B.C.

TARQUINIUS, Lucius, surnamed *Superbus* (the proud). The last of the legendary kings of Rome, the son of Lucius Tarquinius Priscus, reigned from 534-510 B.C. He abolished the privileges conferred on the plebeians; banished or put to death the senators whom he suspected, never filled up the vacan-

cies in the senate, and rarely consulted that body. He continued the great works of his father, and advanced the power of Rome abroad both by wars and alliances.

By the marriage of his daughter with Octavius Mamilius of Tusculum, the most powerful of the Latin chiefs, and other political measures, he caused himself to be recognised as the head of the Latin confederacy. In 510 B.C. a conspiracy broke out by which Tarquinius and his family were exiled from Rome, an infamous action of his son Sextus being part of the cause of the outbreak (*see* LUCRETIA). He tried repeatedly, without success, to regain his power, and at length died at Cumæ in 495 B.C.

TARRAGON (*Artemisia Dracunculus*). A strong erect perennial plant of the composite order, a native of Siberia, cultivated in gardens for flavouring dishes.

TARRAGO'NA. A maritime province of North-Eastern Spain. It is traversed by the Ebro in the south, and, although mountainous, is agriculturally rich, viticulture being prominent, and all kinds of cereals, etc., being raised. Manufactures include silks, velvets, soap, leather, and spirits, and fisheries are notable. Tarragona is the capital. Area, 2505 sq. miles; pop. (1931), 350,220.

TARRAGONA (ancient **Tarraco**). A seaport of Spain, capital of the province of Tarragona, on the Francoli. The town was founded by the Phœnicians, and was long important under the Romans. In its environs are an ancient amphitheatre, a circus, an aqueduct, etc. There is a large number of *bodegas* or wine-cellars. It has a trade in corn, wine, and fruit. Pop. (1931), 30,747.

TARRA'SA. An industrial town of Spain, in the province of Barcelona. Manufactures include cottons and woollens. Pop. 22,679.

TARSIA-WORK (It., from Lat. *interserere*, to insert). A kind of mosaic woodwork or marquetry much in favour in Italy in the fifteenth century. It was executed by inlaying pieces of wood of different colours and shades into panels of walnut-wood, so as to represent landscapes, figures, fruits, flowers, etc. At Sorrento and other places the manufacture of wood-mosaic, in modern times, has become celebrated.

TARSIUS. A genus of mammals of the lemur family inhabiting the Eastern Archipelago. In this genus the bones of the tarsius are very much elongated, which give the feet and hands a disproportionate length. *Tarsius spectrum*, the spectre tarsier, seems to be the only species known. It is about the size

Spectre Tarsier

of a squirrel, fawn-brown in colour, with large ears, large eyes, and a long tufted tail. It is nocturnal in its habits, lives among trees, and feeds upon lizards.

TARSUS. In anatomy, that part of the foot which in man is popularly known as the ankle, the front of which is called the instep. It corresponds to the wrist of the upper limb or arm, and is composed of seven bones. (*See* FOOT.) In insects the tarsus is the last segment of the leg. It is divided into several joints, the last being generally terminated by a claw, which is sometimes single and sometimes double. In birds the tarsus is that part of the leg (or properly the foot) which extends from the toes to the first joint above; the shank.

TARSUS (modern **Tersous**). An ancient city of Cilicia, Asia Minor. The Apostle Paul was born, and Julian the Apostate was buried there. Its inhabitants enjoyed the privileges of Roman citizens, and the city even became a rival of Athens, Antioch, and Alexandria. Tersous stands on the Cydnus, has a flourishing trade, and is connected by railway with Adana and the port of Mersina.

TARTAN. A species of cloth checkered or cross-barred with threads of various colours. It was originally made of wool or silk, and constituted the distinguishing badge of the Scottish Highland clans, each clan having its own peculiar pattern. An endless variety of fancy tartans is now manufactured, some of wool, others of silk, others of wool and cotton, or of silk and cotton.

The tartan patterns are used e

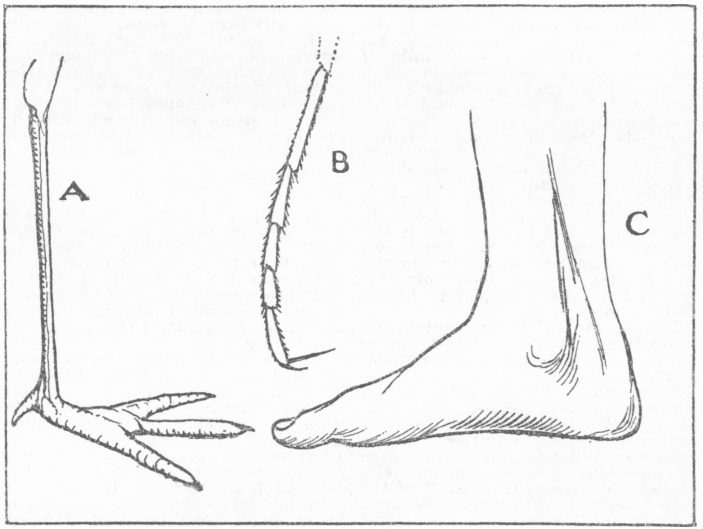
tensively for the decoration of travelling-rugs; in some cases the cloths are single make and composed of comparatively thick yarns; while in other cases equally thick fabrics are woven from much finer yarns, by double-structure; and in the latter examples the two exterior surfaces of the rug are often adorned with two quite different tartans.

TARTAR EMETIC. Potassium antimonyl tartrate, $K(SbO)C_4H_4O_6$, prepared by heating cream of tartar with antimony oxide and water. It crystallises in small octahedra, and is used medicinally as an emetic.

TARTARIC ACID. Dihydroxy-succinic acid, $C_2H_2(OH)_2(COOH)_2$, an important vegetable acid occurring in the juice of the grape and in many fruits associated with malic acid. It is prepared from argol (*see* CREAM OF TARTAR). It crystallises in large monoclinic prisms soluble in water and alcohol. It has a sour taste, is odourless, and is a dibasic acid. On heating it melts and then decomposes, yielding several compounds.

It exists in four stereoisomeric forms, *lævo-tartaric acid*, *dextro-tartaric acid*, *meso-tartaric acid*, and *racemic acid*, the first two of which are optically active (*see* STEREOCHEMISTRY; POLARISATION OF LIGHT). Naturally occurring tartaric acid is dextro-rotatory. It is used medicinally, the sodium potassium salt (*Rochelle salt*) forming the basis of Seidlitz powders; to some extent in calico-printing as a discharge; and in certain baking-powders.

TAR'TARUS. A deed and sunless abyss, according to Homer and the earlier Greek mythology, as far below Hades (q.v.) as earth is below Heaven. It was closed by iron gates, and in it Zeus imprisoned the rebel Titans. Later poets describe Tartarus as the place in which the spirits of the wicked receive punishment.



Tarsus. A, Bird. B, Insect. C, Man

TARTARY, GULF OF. A strait of the Pacific Ocean, between Siberia and Sakhalin.

TARTU. *See* DORPAT.

TASHKENT', or **TASHKEND'**. A town in the Uzbek S.S.R., Russia, on the Tchirshik, near its confluence with Sir Darya. It is connected by rail with Orenburg. It has a University founded in 1919. Manufactures include silks, cottons, iron goods, etc., and trade, carried on chiefly by caravans, but partly by railway, is very extensive. Pop. (1926), 421,800.

TASMA'NIA. An island state, the smallest of the Australian Commonwealth, separated from the continent by Bass Strait (q.v.); area, 26,215 sq. miles (main island, 24,330 sq. miles). There are fifty-five adjacent islands, mostly in Bass Strait. The Furneaux group (with Flinders Island), King's Island, Maria Island (on the east coast), and Bruny Island (south coast) are the chief. (*See* Table of Comparative Areas, under QUEENSLAND.) The total population is (1931), 219,694.

Physiography. There is a coastline of 900 miles (i.e. about 27 sq. miles of territory to each mile of coast-line). Cradle Mountain (5069 feet altitude), the Frenchman's Cap (4756 feet), and Ben Lomond (5010 feet) are the chief peaks. Rivers include the Derwent, Huon, Arthur, and Tamar. The chief lakes are Great Lake (area, 28,000 acres), Lake Sorell (12,300 acres), and Lake St. Clair (10,000 acres). *Climate.* Captain Cook described it as "the finest in the world," and it certainly is exceedingly equable. In December, January, and February, the summer months, the average temperature is 62°, and in winter 47°, or 8° higher than London.

Towns. Hobart is the capital; its population in 1932 was 58,270. Launceston, on the Tamar, has a population of 31,210.

Production. Wheat, oats, barley, potatoes, pease, beans, and hops are largely cultivated, and the fruit includes grapes, cherries, plums, quinces, mulberries, peaches, apricots, walnuts, filberts, almonds, etc. Apples are exported, one-half of the crop reaching European markets. Ale from Tasmania is in great demand in Australia. Much wool is produced and exported. Other exports are: jam, tanning bark, calcium carbide, timber, wolfram, gold, copper, silver, tin, lead, and zinc. In order of importance the chief mineral products are: copper, tin, argentiferous lead, zinc, osmiridium, coal, gold, and wolfram. The Mount Lyell copper-mine is one of the world's greatest. Much of the island is heavily timbered.

Social Conditions: Religion. The bulk of the people are Anglican, with Roman Catholics a bad second, and Presbyterians third. **Education.** There is, at Hobart, a University of Tasmania, granting degrees in arts, science, law, engineering, and commerce. State high schools tend to supplant the older "secondary" schools, both public and private. Primary education is free, compulsory, and non-sectarian.

Government. There is a Central Government with a bicameral legislature. The Legislative Council has 18 members, and the House of Assembly 30, both elected. For local government purposes there are 48 municipalities, besides Hobart and Launceston.

History. Tasmania was discovered (1642) by Abel Jansen Tasman, who named it after Van Diemen, the Governor of the Dutch East Indies. It was visited by Cook in 1769, and annexed to Britain in 1803, when the first settlement was made as a penal auxiliary to Botany Bay. In 1816 voluntary settlers began to arrive, and, following the separation from Botany Bay (1825) and the arrival of the last convicts (1853) the name Tasmania was adopted and responsible government granted, and in 1901 Tasmania was federated with the other Australian colonies.

TASMANITE. A flaky, resinous, brown coal occurring in Tasmania.

TASSO, Torquato. Italian epic poet, son of Bernardo Tasso (1493-1569), also a poet, born at Sorrento 1544, died 1595. He was early sent to the school of the Jesuits at Naples, and subsequently pursued his studies under his father's superintendence at Rome, Bergamo, Urbino, Pesaro, and Venice.

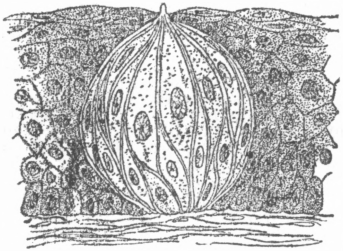
At the age of sixteen he was sent to the University of Padua to study law, but at this time, to the surprise of his friends, he produced the *Rinaldo*, an epic poem in twelve cantos. The reputation of this poem procured for Torquato an invitation to the University of Bologna, which he accepted. Here he displayed an aptitude for philosophy, and began to write his great poem of *Gierusalemme Liberata* (Jerusalem Delivered).

While engaged on it he secured a patron in Cardinal Louis d'Este, to whom he had dedicated his *Rinaldo*. He was introduced by the cardinal to the court of Alfonso II. of Ferrara. Here he remained from 1565 to 1571, when he accompanied the cardinal on an embassy from the Pope to Charles IX. of France. Having quarrelled with his patron, Tasso returned to Ferrara, and in 1573 brought out the *Aminta*, a pastoral, which was represented at the court.

In 1575 he completed his epic of *Gierusalemme Liberata*. About this time he became a prey to morbid fancies, believed that he was persistently calumniated at court, and systematically misrepresented to the Inquisition. To such a pass, indeed, had this mania come in 1577 that the poet drew his poignard upon one of the domestics of the Duchess of Urbino. He was immediately

arrested, but was set at liberty after two days' confinement.

At his own request he returned to Ferrara, to the convent of St. Francis; but from here he made his escape, and travelled in disguise to his native place, Sorrento, where he stayed with his sister Cornelia. He



A "Taste Bud"

One of the numerous tiny elevations on the tongue which send impulses to the brain to be interpreted there as tastes.

again asked permission to return to Ferrara, a request which the duke coldly granted. But in his excited and jealous condition of mind Tasso found it impossible to re-establish the old friendly relationship at the court. He fled from Ferrara again, but again returned.

So outrageous had his conduct now become that he was seized by the duke's orders and confined as a madman in the hospital of St. Anne at Ferrara. Here he remained from 1579 to 1586, until he was released at the solicitation of Vincent di Gonzaga. Broken in health and spirit, he retired to Mantua, and then to Naples. Finally, in 1595, he proceeded to Rome at the request of the Pope, who desired him to be crowned with laurel in the capitol, but the poet died while the preparations for the ceremony were being made.

Tasso wrote numerous poems, but his fame rests chiefly on his *Rime*, or lyrical poems, his *Aminta*, and his *Gierusalemme Liberata*. His letters are also interesting.—BIBLIOGRAPHY: Editions—A. Solerti Florence, 1895-6, 3 vols.). Translations—E. Fairfax; John Hoole. Biographies—R. Milman, *Life of Tasso*; A. Solerti, *Vita di Torquato Tasso*; W. Boulting, *Tasso and his Times*.

TASSO'NI, Alessandro. Italian poet, born 1565, died 1635; chiefly known from his mock-heroic poem *La Secchia Rapita* (The Rape of the Bucket), founded on an incident that gave rise to war between the Modenese and Bolognese in the thirteenth century.

TASTE. The sense by which we perceive the relish or savour of a thing. The organs of this special sense are the *papillæ*, or processes on the surface of the tongue, and also certain parts within the cavity of the mouth and the throat, as the soft palate, the tonsils, and the upper part of the pharynx. *See* TONGUE.

TATAR REPUBLIC. *See* RUSSIA (table).

TATARS, or TARTARS. The Russian term for the 3 million Turanian, and generally Muslim, tribes of Turkish origin settled within the confines of the former Imperial frontiers. The term Turko-Tatar is used by scholars to designate non-Russian Turks, but is regarded as an insult by the Turks proper, who recognise no such ethnic (anthropological) designation. *Tartar* is derived from the Fr. *Tartare*, a collective term for Turks, Mongols, and Tunguses (and sometimes Finns).

Tatars or Tartars

According to the Arabic author Abulghazi, a descendant of Turk, one of the eight sons of Japhet, had twin sons, Tatar and Mongol. *Mongol*, however, does not appear in the Chinese annals, and from A.D. 880

onwards *Tata* is common as a name for certain wild hordes of the In-Shan. The term *Tatar* was introduced into Europe by the Russians, and, although only the name of the tribal rearguard of the armies of Jenghiz Khan, it soon embraced Turks and Mongols.

TATE, Nahum. Dramatist, poet-aster, and Poet Laureate, born in 1652, and died in 1715. He was educated at Trinity College, Dublin, where he graduated B.A. in 1672. His first drama, *Brutus of Alba*, founded on the story of Æneas and Dido, appeared in 1678. He then undertook to improve several of Shakespeare's plays, a task for which he was eminently qualified by total lack of poetic and dramatic ability. He metamorphosed *Richard II.* into *The Sicilian Usurper*, but even in this camouflaged form the play proved too full of political allusions to suit a Restoration audience, and it was suppressed after three performances.

Tate's version of *King Lear* actually secured the banishment of Shakespeare's version from the stage until 1840. Tate cut out the part of the Fool, and made the play end happily with the marriage of Cordelia to Edgar. *Coriolanus* turned into *The Ingratitude of a Commonwealth* in 1682.

Tate also improved plays by Fletcher and Webster, and *Eastward Ho!* by Jonson, Chapman, and Marston. Dryden employed him in 1682 to write the second part of *Absalom and Achitophel*.

In 1692 he was appointed Poet Laureate; he has strong claims (contested by Pye and Eusden) to be considered the least distinguished holder of that office. In 1696, having finished with Shakespeare, he turned his attention to the Psalms; and in that year his *New Version of the Psalms*, written in collaboration with Dr. Nicholas Brady, appeared. This version, though it attained almost universal use, is devoid of all poetic merit.

TATE GALLERY. The popular name for the National Gallery of British Art, presented to the nation by Sir Henry Tate, Bart. (1819-99), in 1897, and added to by Sir Joseph Duveen, the new wing being opened in 1910. The Gallery is situated in Millbank, London, and Sir Joseph Duveen has gifted a Gallery of Modern Foreign Art, which will be erected beside it.

TATIAN. Christian apologist of the second century. A native of Assyria, he was educated in Greek philosophy; travelled extensively; caused himself to be initiated in the rites of various religions; and eventually embraced Christianity. Tatian became a disciple of Justin, after whose martyrdom he left Rome and journeyed into Mesopotamia, where he preached certain Gnostic and heretical doctrines.

He seems to have disbelieved in the divinity of Christ, and his teaching inculcated abstinence from wine, from animal flesh, and from marriage. As a Christian apologist he wrote *Oratio ad Græcos*, which is still extant, and his *Diatessaron* seems to prove the existence of four gospels about the middle of the second century. The Latin version of the latter work was translated into English by Hill.

TATTERSALL'S. At Knightsbridge Green, London. The great metropolitan mart for horses, and headquarters of the turf; removed in 1685 from Grosvenor Place, where it was established by Richard Tattersall (1724-95) in 1773.

TATTERSHALL. Village of Lincolnshire. It is 9 miles from Horncastle. There is an interesting church and a village cross, but the place is more famous for its castle. The present building, long a seat of the Cromwell family, dates from the fifteenth century. It was restored by the marquess Curzon and presented to the nation. It is a magnificent example of mediæval brickwork.

TATTOOING denotes the practice of making permanent coloured designs or figures in the skin by means of very small punctures or incisions, which receive various dyes or pigments. This method of tattooing is to be distinguished from the custom of scarification, scar-tattooing, or cicatrisation, which is practised by the dark-skinned people, and which consists in repeatedly cutting the skin at the same place so that in healing a raised scar is left.

The custom of tattooing is found among numerous nations of different degrees of cultural development, as among the aborigines of Australia the Polynesians, the Ainus of Japan the old Egyptians, and probably among the Israelites, as may be inferred from the prohibition in Lev xix., 28.

Colour tattooing of an ornamental kind reached its most artistic development among the Maoris of New Zealand and the Japanese, but both these nations have almost completely abandoned the practice under the influence of civilisation.

The origin of tattooing has been ascribed to the custom of making

blood-offerings to the departed spirits, to primitive therapeutics, to religious reasons, and especially to a desire of primitive man to beautify his body, and to the motive of sex attraction. As a rule, colour tattooing is generally ornamental, but scar-tattooing is more frequently used to produce distinguishing tribal marks. The practice of colour-tattooing is very prevalent among sailors of all nationalities.

TAUCHNITZ (touh'nits), **Bernhard Christian, Baron.** German publisher, born 1816, died 1895. His establishment at Leipzig, founded in 1837, is widely known from the collection of British authors issued from it, which numbers over 4000 volumes, and is continually increasing. Baron Tauchnitz was British Consul-General for Saxony.

TAUNTON. A municipal borough of Somerset, England, on the Tone. The castle is of very ancient foundation, and now contains an archæological and natural history museum; there are also an old market-house and the Shire Hall. The town was long celebrated for woollens; it now manufactures silks and gloves, has foundries, coach-works, breweries, etc. It is an important agricultural centre. Taunton is of great antiquity, and was a residence of West Saxon kings. The district around is called **Taunton Deane.** Pop. (1931), 25,177.

TAUNTON. A city of Massachusetts, United States, one of the county seats of Bristol county, on Taunton River; served by the Old Colony branch of the New York, New Haven, & Hartford Railway. It is a herring-fishery centre, and has varied manufactures and a heavy shipping trade. Pop. (1930) 37,355.

TAUNUS. A mountain range of Western Germany, mainly in Hesse-Nassau, extending eastward from the Rhine, north of the Main; highest summit, Great Feldberg (2887 feet). It contains the mineral springs of Wiesbaden, Homburg, and Nauheim.

TAU'RIDA. A former government of Imperial Russia, now included partly in the Ukranian S.S.R., and partly in the Crimean A.S.S.R.; area, 4,497 sq. miles. It contained the Crimea, and was drained by the Dnieper. Cattle-breeding and agriculture were important. Simferopol was the capital.

TAURUS. The Bull. One of the twelve signs of the zodiac, which the sun enters about the 20th April. Taurus is also the second zodiacal constellation. Its brightest star, of orange colour and of the first magnitude, represents the eye of the Bull, and is named Aldebaran. Close by is the group of stars called the Hyades. The constellation also contains the well-known beautiful cluster of the Pleiades.

TAURUS. A mountain chain of Asia Minor, stretching for about 500 miles from the Euphrates to the Ægean Sea, afterwards running north of the Gulf of Adalia. In the east it takes the name of Ala Dagh, in the west that of Bulghar Dagh, the pass between the two being the Cilician Gate. It descends steeply to the sea on the south; northwards it merges gradually into the plateau of Asia Minor. It is connected by the Alma-Dagh with the chain of Lebanon; and by Anti-Taurus, with Ararat, Elburz, and the Caucasus.

TAVISTOCK. A market town of Devonshire, England, in the valley of the Tavy. A canal connects it with the Tamar. Here are Kelly College and Endsleigh, the seat of the Duke of Bedford, whose eldest son is called the **Marquess of Tavistock.** Manganese, copper, silver, tin, and lead are worked near by, and arsenic is produced from the copper ore. The town has an agricultural trade. Sir Francis Drake was a native. Pop. (1931), 4453.

TAVOY. A district and town in the Tenasserim division of Lower Burma. The district extends east and west between the Siamese frontier and the Bay of Bengal, and is very rugged, except in the valley of the Tavoy River and along the coastal plain. Rice is the staple crop. The town, on the Tavoy River, is the district headquarters, and has a monopoly of the transit trade with Rangoon, Calcutta, and Malaya. Area, 5308 sq. miles; pop. (district), 156,786; (town), 27,480.

TAXA'CEÆ. A sub-order of Coniferæ, sometimes regarded as a distinct order, comprising the yew tree (Taxus) and other trees or shrubs which inhabit chiefly the temperate parts of Europe, Asia, Africa, and America.

TAXATION. The compulsory levies which a central government makes upon the citizens of a state for funds with which to carry on the national services are called taxes, while the levies of local government authorities are called rates. The national system of taxation is generally regarded as including both rates and taxes. Besides this broad division, based upon the character of the authority by whom the levy is made, there are many different ways in

which taxes may be classified. Of these the most familiar is the distinction drawn between "direct" and "indirect" taxation.

Direct taxes are assessed upon corporations or individuals, and are generally intended to fall upon those who pay them, and not to be passed on to others. Indirect taxes are assessed upon goods, and their burden tends to be passed on with the goods until it reaches the consumer, upon whom it ultimately falls. Some taxes do not fit conveniently into this classification. On the whole, however, it is the most important and useful method of discriminating between sources of national revenue, and it has been generally adopted.

Direct Taxation. The most productive tax imposed in this country has for many years been the *income tax*. This is a charge upon income and profits of every description, designed to fall directly upon the recipient of income, and graduated in proportion to his wealth. It was originally instituted in 1798, during the war with France, and it was repealed in 1815. In 1842 it was reimposed by Sir Robert Peel, as a substitute for a large number of duties on imports and exports, to tide over the institution of free trade finance.

It was again regarded as a temporary expedient; but it proved too productive to be discarded, and it has not only become permanent and the largest source of national revenue, but the rate at which it is levied has steadily risen. In the years immediately preceding the European War, the income tax stood at 1*s.* 2*d.* in the pound. Incomes under £160 were exempt from this tax. Earned income was taxed at the rate of 9*d.* in the pound if the total income did not exceed £2000, at 1*s.* if it did not exceed £3000.

Earned incomes over £3000, and all incomes from property, were taxed in full, subject to abatements for individuals whose total income did not exceed £700. In 1909 a super-tax, now called a surtax, was levied, in addition to the income-tax proper, on all incomes in excess of £5000 a year.

The outbreak of the Great War caused a great increase in the rate of income-tax, and at one time it was raised to 6*s.* in the £, apart from the super-tax. In 1920, after the end of the war, a royal commission inquired into the matter, and the system as it is to-day was established. No tax is payable on an income of £100, or on £150 if it is the joint income of a married couple. In addition there are allowances for children, life insurance premiums, etc., so that a man with a large family may pay nothing, although his income is £400 or £500 a year. In addition, the first £175 of taxable income, as it is called, pays at a lower rate. Thus in 1932, when the rate was 5*s.* in the £, the first £175 of taxable income was only charged at 2*s.* 6*d.* in the £. The taxpayer is allowed to deduct one-fifth of his earned income and only pay on the balance, but he can only do this up to a maximum of £1500 a year. There are arrangements with Australia, Canada, the Irish Free State and other parts of the Empire to prevent a person from paying tax twice on the same income.

The tax is levied once a year. A form is sent to each taxpayer, who fills up the amount of his income during the previous twelve months. On this he is charged and the amount is paid in two instalments, except that manual workers can pay quarterly. Three-quarters of the tax is paid in the first (January) instalment, and one-quarter in the second. The Board of Inland Revenue looks after the collection of the tax, and there are collectors and inspectors all over the country. In 1932-3 the amount estimated by the Chancellor of the Exchequer to be raised from income-tax was £251,539,000, and from surtax £60,650,000.

Another very important branch of direct taxation is comprised in the *death duties*. In Great Britain they consist of estate duty and legacy duty. These are charges imposed by the Government upon property which is being transferred from the dead to the living. Very large sums pass into the national exchequer through this channel, and since the power to inherit property is conferred by the State, it is fitting that it should be subject to a substantial contribution to State funds.

An objection to heavy death duties is sometimes based upon the ground that they constitute a tax upon capital, and therefore tend to diminish the capital available for industry. The validity of this argument appears, however, to depend upon the assumption that incomes are never saved, and that capital is never squandered.

Indirect Taxes. The taxes levied upon commodities are divided into two groups: *customs duties*, which are charged upon articles imported from other countries; and *excise duties*, which fall upon commodities produced at home. Under a system of protection (q.v.) customs duties are imposed for other than revenue-raising purposes; but in free trade (q.v.) an excise duty equal in amount

to the customs duty is placed upon any home product which competes with a taxed import.

Local Taxation. Local government authorities frequently derive revenue from the ownership of property and from trading monopolies, such as water, gas, electricity, and tramway services; but they also raise money by taxation. The principal instrument of local taxation is a *rate* levied upon the rent of real property, such as lands, houses, railways, and mines. The incidence of these rates is a frequent subject of dispute, but, though the duty of paying the rates is sometimes apportioned between the owner and the occupier of property, there can be no doubt that, as a rule, they are deducted in the long run from the rent obtainable.

Equity in Taxation. Adam Smith laid down four maxims with regard to the conditions which a good system of taxation should fulfil; and, though many economists and statesmen have tried to improve upon them, they still command general assent. These maxims are: "(1) The subjects of every State ought to contribute towards the support of the Government as nearly as possible in proportion to their respective abilities, that is, in proportion to the revenue which they respectively enjoy under the protection of the State. (2) The tax which each individual is bound to pay ought to be certain and not arbitrary. The form of payment, the manner of payment, the quantity to be paid ought to be clear and plain to the contributor and to every other person. (3) Every tax ought to be levied at the time or in the manner in which it is most likely to be convenient for the contributor to pay it. (4) Every tax ought to be so contrived as both to take out and to keep out of the pockets of the people as little as possible, over and above what it brings into the public treasury of the State."

To these canons of taxation little need be added. In practice, however, there is often a conflict between the desirability of making each citizen conscious that he is contributing his share to the national exchequer, and the natural desire of a Government to extract "the maximum of feathers with the minimum of squeals."

TAXIDERMY. The preservation of the skins of animals, birds, or fishes, and the mounting of them to display, as far as possible, the creature in a life-like form, is a comparatively modern art, little more than three hundred years old. It was practised in this country in the seventeenth century, as is shown by the natural-history specimens in the Sloane collection; but till about 1850 British practitioners were far behind both French and German.

Since then, however, great advances have been made in British work, and the best artists here and in America have now little to learn from the Continent. The first step in taxidermy is obviously the stripping of the skin from the dead body, which must be accomplished without damage to the fur of animals, the feathers of birds, or the scales of fishes. Next come the measures for preserving the skin from decay.

The preparations in use are of many different kinds. Those containing arsenical soap or corrosive sublimate are effective, but highly poisonous, and may be dangerous to the lungs and blood of the worker. A mixture of burnt alum and saltpetre is effective for most mammals, while fur and feathers are usually treated with benzoline.

In *setting up* the specimen, stuffing is now almost discarded. A copy is made of the animal, posed in a natural and life-like position, and from this a "manikin" of light material is constructed, to which the skin is fitted with much artistry and care. The inside of the jaws and mouth is moulded of some plastic material; while the old-fashioned staring and expressionless glass eyes have given place to hand-painted models of the living organ.

In modern natural-history museums the finished figure is given an elaborate setting which reproduces the natural habitat. With such perfection of reproduction in view, it is obvious that the taxidermist must have not only much artistic taste and manual skill, but also a fairly wide knowledge of the habits and appearance in life of the animals with which he deals.—Cf. Montagu Browne, *Artistic and Scientific Taxidermy.*

TAXIMETER. An instrument by means of which the distance travelled by a motor or other vehicle may be recorded in terms of the hire rate. They are most commonly used in cabs. The mileage records are obtained from a train of gearing, the first wheel of which receives its motion from one of the front wheels by a flexible shaft. On the last wheel of the train there is a pin fitted at the point corresponding

to the performance of a complete mile of travel, and followed by others to represent the additional quarter miles. Other settings than that indicated are, of course, possible.

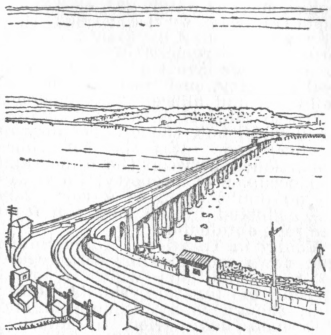
The position of a metal flag indicates whether the mechanism is in operation or not. As a car may be engaged on a combined system allowing for running- and waiting-time, clockwork is fitted to operate similar gear to that mentioned above when the car is stopped. The instruments fitted to taxi-cabs are subjected to tests by the local authorities before being put into service.

TAXO'DIUM. A genus of plants, nat. ord. Coniferæ. Th *T. distichum*, or deciduous cypress, a common ornamental tree upon English lawns, is a native of North America. When growing in swamps, as it often does, it develops cone-shaped breathing-roots. The bark exudes a resin which is used by the negroes for dressing wounds, and the roots, which are hollow inside, are used for bee-hives.

TAY. The longest river in Scotland, and the one that carries to the sea a greater volume of water than any other in the British Islands. It rises on the north side of Ben Lui, near the borders of Argyllshire and Perthshire; is known in its earliest course as the Fillan, and enters Loch Tay (after being joined by the Lochy) as the Dochart; issues thence as the River Tay, and receives in its course the Lyon, Tummel, Garry, Isla, Bran, Earn, Almond, etc.; passes the towns of Aberfeldy, Dunkeld, and Perth; and at the latter place widens out into the Firth of Tay, and finally enters the North Sea after a course of 120 miles. The drainage basin is 2400 sq. miles. The estuary is from 1 to 3½ miles wide. It is navigable as far as Perth, but Dundee is the chief port. The salmon-fisheries are important.

TAY, LOCH. A loch of Scotland, in the county of Perth, 15 miles long and about 1 mile broad; receiving at its south-west end the Lochy and the Dochart, and discharging at its north-east end at Kenmore by the Tay. It is 508 feet deep (maximum), and is famous for salmon.

TAY BRIDGE. A great railway bridge in Scotland crossing the estuary of the Tay from Fifeshire to Forfarshire at Dundee. The first bridge built here was opened for traffic in 1878. It was nearly 2 miles long, and had eighty-four spans, thirteen of which were blown down during the passage of a passenger train in a violent storm on the 28th Dec., 1879. A new and more substantial bridge (2 miles 73 yards long), containing eighty-five piers, was opened in June, 1887.



Tay Bridge

TAYLOR, Bayard. American author, born 1825, died 1878. He learned the trade of a printer, contributed to various magazines, made a journey through Europe on foot in 1844-5, on his return published *Views Afoot in Europe*, and in this way gained a position on the staff of the *New York Tribune*. He afterwards travelled extensively in Mexico, Egypt, Syria, Asia Minor, China, India, Japan, Greece, Sweden, and Russia, relating his experiences in numerous books.

He is chiefly remembered for his complete translation of Goethe's *Faust* in the original metres; this is probably the best English translation of the poem. He resided in Germany for lengthened periods, was for some time United States Secretary of Legation at St. Petersburg (Leningrad), and was afterwards United States Ambassador at Berlin, where he died.

TAYLOR, Brook. English mathematician, born 1685, died 1731. Chosen a Fellow of the Royal Society, he became its secretary in 1714, an office which he retained four years. His chief works are: *Methodus Incrementorum Directa et Inversa* (London, 1715) and *Linear Perspective* (London, 1715). He was discoverer of the mathematical formula called *Taylor's Theorem* (q.v.), of extensive application in the higher mathematics.

TAYLOR, Jeremy. English prelate and author, born in 1613 at

Cambridge, died at Lisburn, Ireland, in 1667. Educated at Perse's Free School in his native place, he entered Gonville and Caius College as a sizar in 1626. He graduated M.A., and in 1636, obtained, by the patronage of Archbishop Laud, a fellowship at All Souls College, Oxford. In 1638 he was presented by Bishop Juxon to the rectory of Uppingham, in Rutlandshire, and in 1642 he was appointed chaplain in ordinary to Charles I.

After the outbreak of the Civil War he continued to attend Charles as chaplain, and when the Parliamentary party proved victorious he was frequently imprisoned for short periods. Eventually he retired into Wales, where he was received by the Earl of Carbery, under whose protection he was allowed to exercise his ministry and keep a school.

Afterwards he removed to London, but in 1658 he accepted an invitation from Lord Conway to reside at his seat in Ireland. Here he remained until the Restoration, when he was elevated to the Irish see of Down and Connor, with the administration of that of Dromore. He was also, in the same year, made a Privy Councillor for Ireland, and chosen vice-chancellor of the University of Dublin. The greater part of his writings consists of sermons and devotional pieces, and upon the former rests his fame as a master of varied English prose.—Cf. E. W. Gosse, *Jeremy Taylor* (English Men of Letters Series).

TAYLOR, John. Usually called the *water-poet*; born in Gloucester about 1580, and died in 1653. He served an apprenticeship to a waterman, was at the taking of Cadiz, under the Earl of Essex, in 1596, and was many years collector of the wine dues exacted by the lieutenant of the Tower of London.

He afterwards kept a tavern, first at Oxford and then at Westminster. His pieces to the number of sixty-three were published in a folio volume in 1630, but he was the author of about one hundred and fifty publications, both in prose and verse. They are characterised by a certain rough vigour not free from vulgarity. His works, among which may be mentioned *Penniless Pilgrimage* (1618); *Laugh and Be Fat* (1613); *Three Weeks', Three Days', and Three Hours' Observations and Travel from London to Hamburgh* (1617), were reprinted by the Spenser Society (1868-9 and 1870-8).

TAYLOR, Thomas. The "Platonist," born in London 1758, died at Walworth 1835. He studied with a view to the dissenting ministry, but entered a banking-house, when all his leisure was devoted to classical and philosophical studies. He published, chiefly with the aid of patrons, about forty different works, the most remarkable of which are *Plato* (5 vols. 4to, 1804), printed at the expense of the Duke of Norfolk, who kept almost the whole edition locked up till 1848; and *Aristotle* (10 vols. 1806-12).

TAYLOR, Tom. British dramatist, born 1817, died 1880. Educated at Glasgow University and Trinity College, Cambridge, he became professor in University College, London; was called to the Bar (1845), and went on the northern circuit; appointed (1854) secretary to the Board of Health; wrote and adapted for the stage a great number of plays; and succeeded Shirley Brooks (1873) as editor of *Punch*. The most popular of his plays were: *New Men and Old Acres*, *Masks and Faces* (in collaboration with Charles Reade), *Still Waters Run Deep*, *The Overland Route*, and *The Ticket of Leave Man*.

TAYLOR, William. Born at Norwich in 1765, died 1836. He was educated for a mercantile career, but after a lengthened stay in Germany he resolved to devote himself to literature. His published works are: a translation of Bürger's *Lenore* (1796) and Lessing's *Nathan the Wise* (1805), *English Synonyms Discriminated* (1813), and *A Historic Survey of German Poetry* (1828). George Borrow has described him as the "elderly individual" in *Lavengro*, chapter xxiii.

TAYLOR, Zachary. Twelfth President of the United States, born in Virginia 1784, died in 1850. He entered the army in 1808, and rose to the rank of major; took command of the United States forces at the outbreak of the Mexican War, repeatedly defeated the Mexicans, and finally triumphed over Santa Anna in the battle of Buena Vista (1847). Having returned to the United States, his popularity caused him to be elected President.

TAYLOR INSTITUTION. An institution in connection with Oxford University, designed mainly for the promotion of the study of modern European languages. It owes its foundation to a bequest of Sir Robert Taylor (1714-88), and the building belonging to it was erected in 1848, after a design by C. R. Cockerell.

TAYLOR'S THEOREM. a formula essentially identical with Mac-

laurin's Theorem (q.v.), but more convenient in form for some applications. If $f(x)$ is a function of x, the theorem is that

$$f(b)=f(a)+\frac{b-a}{1}f'(a)+\frac{(b-a)^2}{1\cdot 2}f''(a)+\ldots$$
$$+\frac{(b-a)^n}{n!}f^{(n)}\{a+\theta(b-a)\},$$

where θ is a positive proper fraction. Under certain conditions, which can be proved to be fulfilled by all the ordinary functions of analysis, the series can be continued to infinity.—Cf. G. A. Gibson, *Elementary Treatise on the Calculus*.

TAYPORT. A port of Fifeshire, Scotland, on the Firth of Tay, 4 miles east of Dundee, with which it is linked by ferry. It has a station on the L.N.E. Railway. The industries include linen and jute mills. Pop. (1931), 3164.

TCHAD, or **CHAD,** A freshwater lake of Central Africa, the nodal point of the French-African and British-Nigerian frontiers; area formerly estimated at 20,000 sq. miles, now at 7000 sq. miles, with a variable expanse according as it is the wet or dry season. It receives the drainage of the Shari and Lagone valleys, but has no outlet. Numerous small islands are studded over the surface, and these are densely peopled, as are also the shores in many places.

TCHAD, or **CHAD.** A colony of French Equatorial Africa. Large herds of camels, horses, sheep, asses, and ostriches are raised, and zinc, lead, and copper exist; but there is no export. Area, 398,955 sq. miles; pop. (1931), 1,053,006.

TCHEKA. Abbreviated form of *Tchresvytchainaja Kommissija* (Extraordinary Commission), an extraordinary commission founded in Russia in 1917 by Dshershinsky (the first commandant) for the suppression of counter-revolution. It soon became a red inquisition and committed terrible atrocities. It is now known as the *Ogpu*.

TCHERKASY. A town and river-port of Ukraine, in the government of Kiev, on the Dnieper; served by the railway to Odessa (via Voznesensk). Sugar and tobacco are manufactured, and there are sawmills. Trade is chiefly in grain, salt, sugar, cattle, and wood. Pop. 26,000 (mainly Little Russians, Poles, and Jews).

TCHERNIGOV, or **CHERNIGOV.** A former government of South Russia, in the Ukraine; area, 20,322 sq. miles. It is mainly an undulating plain watered by the Seim, Desna, and Dnieper. Agriculture and cattle-breeding are the chief employments of the region. The republican (Ukrainian) province of Tchernigov has an area of 10,685 sq. km. and a population of 1,809,918. The population of the Imperial government was (1914), 3,084,000.

TCHERNIGOV. A river-port of Ukrainian S.S.R., Russia, capital of the government of Tchernigov, on the Desna; served by a branch of the Kiev-Voronezh (and Moscow) Railway. It has a radio station. Pop. 34,300.

TCHERN'OZEM. The name for the "black soil" of Russia, rich in nitrogen and naturally the most fertile soil on the globe. It runs as a belt between the Carpathians and the Ural Mountains, and varies in depth from 4 to 20 feet. In the Ukraine it is at its best and widest.

TCHITCHERIN, Georghi Vasilievitch. Russian statesman, born in 1879, of a noble family, but after leaving the university became a revolutionary, and was banished. He was imprisoned in England during the war, and on his return to Russia in 1918 he succeeded Trotzky as Foreign Commissar. His health broke down in 1928, and except for occasional visits to Moscow he lived abroad, mainly in Germany, until January, 1930, when he returned to Russia.

TCHUDES. A subdivision of the Finnic branch of the Finno-Ugric division of the Ural-Altaic family of languages. The Vepsas (Northern Tchudes) are found from east of Lake Ladoga to south-west of Lake Onega: number, 25,000. The Votes (Southern Tchudes) inhabit part of Ingria (the Leningrad district): number, 14,000. Vepsic and Votic are cognate dialects much allied to the Estonian (and Livonian) language.

TEA (Thea). A genus of plants nat. ord. Ternstrœmiaceæ (that to which the camellia belongs), comprising the species (*T. sinensis* or *chinensis*) which yields most of the tea of commerce. By different modes of culture this species has diverged into two distinct varieties entitled *Thea viridis* and *Thea bohea*. The former is a large hardy evergreen plant with spreading branches and thin leaves from 3 to 5 inches long; the latter is a smaller plant and differs from the other in several particulars. From both, according to the process of manufacture, black and green teas are procured.

The tea plant is not only cultivated over a great part of China, but also in Japan, Tonquin, Cochin-China

Assam and other parts of India, and Ceylon. It has also been introduced into the United States, Brazil, South Africa, and Australia. Its growth is chiefly confined to hilly tracts; it is raised from seed, and the rearing of it requires great skill and attention. In seven years the plant attains the height of 6 feet, and the leaves are plucked off carefully one by one four times a year.

In their green condition they are placed in a hot pan over a small furnace, and then rubbed lightly between the palms of the hands, or on a table. This process is repeated until the leaves become small, crisp, and curled. The black teas thus prepared include bohea, congou, souchong, and pekoe; the green teas, twankay, hyson-skin, young hyson, hyson, imperial, and gunpowder.

Green tea gets less of the fire than black tea. The broken leaves, stalks, and refuse of the tea are compressed into solid bricks, and in this form it is imported by the Russians into the greater part of Central Asia, where (besides being used as a sort of coinage) it is sometimes stewed with milk, salt, and butter.

There is considerable adulteration in the teas sent from China to the European market, and they are often artificially coloured with a mixture of Prussian blue, or of gypsum and indigo carefully mixed.

The infusion of tea-leaves in hot water yields a beverage which has little nutritive value, but which increases respiratory action, and seems to have a stimulative and restorative action on the nervous system. This is chiefly due to the essential oil and the theine (a base in its nature identical with the caffeine in coffee) which it contains, whilst the tannin, which is also present, acts as an astringent. If the water is boiling, an infusion of ten minutes is sufficient to extract all the theine, and a longer period only adds to the tannin in the beverage, a result which is very hurtful to digestion.

From historical sources we learn that tea was used in China as a beverage in the sixth century, and two centuries after its use had become common. In England we first find it mentioned about 1615 by an agent of the East India Company; in 1660 Pepys says in his diary, "I did send for a cup of tea, a China drink, of which I never had drunk before;" and in 1664 the East India Company made a present to the king of 2 lb. 2 oz.

In the year 1678 the import of tea to Britain was 5000 lb., forty years after it reached 1,000,000 lb., and in 1929-31 the total imports were:

From	1929 lb.	1930 lb.	1931 lb.
British India	306,734,835	290,183,244	276,963,469
Ceylon	153,095,061	152,397,341	158,913,137
Java, etc.	85,404,476	84,599,549	79,193,531
China	9,195,026	8,734,979	8,547,647
Nyasaland	1,809,260	1,863,595	1,781,486
Other Countries	2,929,100	3,259,620	10,046,642
Total	559,167,758	541,038,326	535,445,912

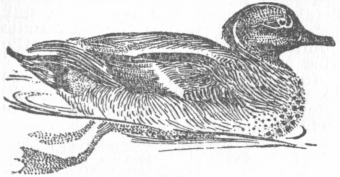
In 1932 about 489,033,000 lb. were imported. China used to hold almost a monopoly in the production of tea, but first India and then Ceylon (after 1873) became important competitors, and now the bulk of all the tea brought to Britain is the produce of these countries.

Britain is the principal tea-consuming country in the world, coffee being less in favour there than in many other countries, the United States and Canada for example. The import of tea to the United States is less than half that of Britain. In 1929 the British tea duty, which yielded an annual revenue of over £5,000,000, was repealed.

TEAK (*Tectŏna grandis*). A tree of the nat. ord. Verbenaceæ, a native of different parts of India, as well as of Burma and of the islands from Ceylon to the Moluccas. It grows to an immense size, and is remarkable for its large leaves, which are from 12 to 24 inches long, and from 6 to 18 inches broad. The wood, though porous, is strong and durable; it is easily seasoned and shrinks but little, and from containing a resinous oil it resists the action of water, and repels the attacks of insects of all kinds. It is extensively used in shipbuilding and for many other purposes. *African teak*, a timber similar to East Indian teak, is believed to be the produce of *Oldfieldia africana*, nat. ord. Euphorbiaceæ.

TEAL. The common name for freshwater ducks of the genus Nettion, the smallest and most beautiful of the Anatidæ, or duck

family. The common teal (*N. crecca*) ranges through Europe and most of temperate Asia. It comes to England about the end of September and remains till spring, but in many

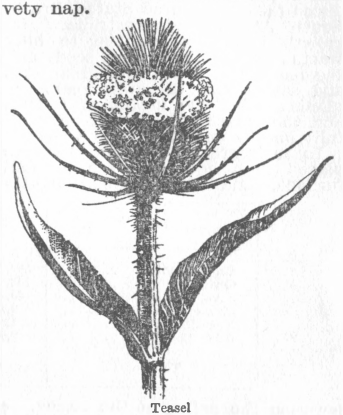


Teal

parts of Scotland it remains all the year. Its length is about 14 inches. The North American green-winged teal (*N. carolinense*) is very like the common teal.

Teak Tree

TEASEL. The English name of several plants of the genus Dipsăcus, nat. ord. Dipsaceæ, allied to the composite order. One species (*D. sylvestris*) grows wild in England, being a strong prickly plant 4 to 6 feet high. Another species, the fuller's teasel (*D. fullŏnum*), by some regarded as a mere variety, is cultivated for the sake of the awns of the head, which are employed to raise the nap of woollen cloths. For this purpose the heads are fixed round the circumference of a large wheel, which is made to turn round while the cloth is held against the brush thus formed, and the fine hooked awn of the teasel draws out with it some of the fine fibres of the wool. These are then shorn smooth, and the cloth is left with a fine velvety nap.



Teasel

TECHNICAL EDUCATION. Special training in the arts or sciences underlying a trade or profession, usually taught in a technical school. It has resulted from changed conditions of production, whereby the master has no time to instruct his apprentice himself. In technical schools there are courses in practical instruction for every kind of trade, and in clerical and linguistic work for commercial purposes. With these may be compared the continental trade schools (e.g. *L'École Diderot* at Paris). Modern types are becoming rapidly more in touch with commercial conditions, and are attracting greater numbers of students. By the Smith-Lever law, the U.S.A. have increased facilities particularly for agricultural instruction.

TECO'MA. A genus of plants, nat. ord. Bignoniaceæ—trees or shrubs or climbing plants, with unequally pinnate or digitate simple leaves, and terminal panicles of dusky red or orange flowers. They are natives of tropical and subtropical climates, and some, as *T. impetiginosa*, are medicinal.

TECTIBRANCHIA'TA. A sub order of the hind-gilled snails (Opisthobranchia), in which the gills are protected by a shell, or by the mantle. Examples are the bubble shells (Bulla) and the sea-hare (Aplysia).

TEDDINGTON. An urban district of England, in the county of Middlesex, on the Thames, 11½ miles from London. It is largely residential, an

contains the National Physical Laboratory for mechanical and industrial research. The authority of the Port of London ceases at Teddington, and that of the Thames Conservancy begins. Pop. (1931), 23,362.

TE DEUM. A name (from the opening phrase *Te Deum laudamus*) of the well-known Latin hymn usually ascribed to St. Ambrose and St. Augustine, although it cannot be traced farther back than the end of the fifth century. It is used in the ritual of the Roman Catholic and Anglican Churches, being part of the morning service in the latter ("We praise thee, O God," etc.).

TEES. A river of England, rising near Cross Fell, in Cumberland, and flowing towards the North Sea, its upper course forming the boundary between Westmorland and Durham. In its lower course it is of commercial importance, and it is estuarine below Middlesborough. Stockton and Thornaby are on its banks. Length, 70 miles; catchment basin, 708 sq. miles (approximate).

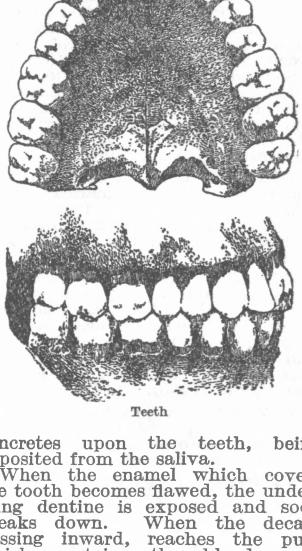
TEETH. The name given to certain hard structures growing out of the jaws of vertebrate animals, and serving as the instrument of mastication. The teeth of animals differ in shape, being destined for different offices. In man and the higher mammals two sets of teeth are developed, the early, milk, or deciduous teeth, and the permanent set.

In fishes the teeth fall off and are renewed repeatedly in the course of their lives. Teeth do not belong to the skeleton, but to the skin or exoskeletal parts of the body, and are homologous with hairs.

In man the teeth are embedded in sockets in the upper and lower jaw-bones. There are thirty-two in all, sixteen in each jaw, and each consists of the crown or visible part, and the fangs or buried part. The four central teeth of each jaw having chisel-shaped crowns with sharp edges are called incisors; on each side of these four is the pointed canine tooth (which in the upper jaw is called the eye-tooth); next to these on each side are two bicuspid teeth (præmolars); and behind these again are the molar teeth, three on each side. (*See* DENTAL FORMULA.)

The last of the permanent teeth to appear are the farthest back grinding teeth, which, owing to their arrival between the seventeenth and twenty-fifth years, are called the wisdom teeth. Each tooth has a central cavity filled with a soft pulp containing blood-vessels and nerves; this cavity is surrounded by dentine, a hard substance composed of phosphate and carbonate of lime; outside the fang is a cement-like substance resembling bone; while outside the crown is a hard enamel.

In young teeth the enamel is covered by a delicate membrane called "the skin of the teeth," which in adult teeth is worn off. Toothache is due to decay, or caries, of the substance of a tooth. Tartar is an earthy substance which occasionally



Teeth

concretes upon the teeth, being deposited from the saliva.

When the enamel which covers the tooth becomes flawed, the underlying dentine is exposed and soon breaks down. When the decay, passing inward, reaches the pulp which contains the blood-vessels and nerves, it causes inflammation, aching, and suppuration. Any treatment of toothache, short of extraction, is seldom satisfactory if the pulp has been actually attacked; but neuralgia is often mistaken for toothache.

TEETHING. A term applied to the eruption of the temporary, or milk, teeth in children, and there is a widespread belief that many disturbances in health are due to this cause, and that it is the origin of certain serious diseases. Most healthy children, however, cut their teeth without any further disturbance than a few days of abnormal irritability, due to the pain of the

swollen and tender gum over the erupting tooth.

In debilitated children, and in those of a nervous type, there is often associated with teething considerable general disturbance of the health of the child, and a rapid rise in temperature may take place with the usual symptoms of feverishness, while convulsive seizures may occur along with the eruption of a tooth in such children. Delay in the appearance of the teeth is one of the signs of constitutional disturbance, and is frequently observed in rickets.

TEGNÉR (teng'nār), **Esaias.** Swedish poet, born in 1782, died in 1846. He studied at the University of Lund, became in 1812 professor of Greek literature, and in 1824 was appointed Bishop of Wexiö. His works include: *Frithjofs Saga*, an epic poem, translated once at least into each European language; and *The Children of the Lord's Supper*, translated by Longfellow.

TEGUCIGALPA. A department of Honduras, Central America, mountainous and forest-clad. Iron, copper, silver, gold, and coal are produced, with grain, etc., in the valleys. Pop. 90-100,000.

TEGUCIGALPA. The capital of Honduras and of Tegucigalpa province, on the Choluteca, the principal distributing centre for the Republic. It has a cathedral, etc., and is connected by rail with the port of San Lorenzo, on Fonseca Bay. Pop. (1930), 40,049.

TEHRĀN. A province of Persia, comprising the districts of Shahriar, Shimran, Saujbulagh, Feshaviyeh, Kasran, and Veramin.

TEHRĀN, or **TEHERAN'.** Capital of Persia and of the province of Tehrān, to the south of the Elburz Mountains. It has an enceinte on Vauban's principle, pierced by twelve gates, with stone bridges crossing the ditch. The main streets lead to the bazaar in the centre, and there are various squares or open spaces. The citadel-palace of the shah is important, but the city is not rich in buildings.

There are numerous mosques, a high school or college, etc. There is a single-line tramway system, and a short railway (5 miles) runs to Shah-Abdul-Azim (1-metre guage; 5½ miles long). During the hotter months the court removes to the heights on the north, and a third of the inhabitants (including the European embassies) follow. The principal manufactures are carpets, silks, cottons, and hardware; there is a large caravan trade. Wireless has been installed, and Teheran is now in communication with Europe. Pop. (in winter), about 350,000.

TEHUANTEPEC (tā-wān-te-pek'). A town of Mexico, in the state of Oaxaca. It gives name to the isthmus, gulf, and inter-oceanic railway. Pop. 9400. The town is near the south side of the Isthmus of Tehuantepec, the narrowest part of North America, having the Gulf of Tehuantepec on the Pacific side, and the Gulf of Campeachy on the Atlantic side; width, about 125 miles.

TEIGNMOUTH (tān'muth). A seaport and market town of England, in the county of Devon, at the mouth of the Teign, and 16 miles south of Exeter. Teignmouth is much frequented as a seaside-resort, and there is a pleasure pier, with a promenade. The fisheries, brewing, and boatbuilding employ a number of the inhabitants. China clay is shippped from the town. Pop. (1931), 10,019.

TEINDS (tēnds). The Scots law term for tenths or tithes of the fruits of the land. In the majority of instances the teinds now belong to the owners of the land formerly paying them, to the Crown, or other proprietors, they being charged in all cases with the payment of the parish minister's stipend.

TEJU, or **TEGUIXIN** (te-gek'sin; *Tupinambis teguixin*). One of the greaved lizards inhabiting tropical America. A full-grown specimen may exceed 3 feet in length. They inhabit forest regions, and devour worms, insects, frogs, snakes, small rodents, and birds. Their hard-shelled eggs are laid in burrows.

TELAU'TOGRAPH. The telegraphing of pictures over long distances has attracted the attention of many inventors, but it is to Professor Korn that the main credit is due for work in this field. In his telautographic process the photograph which is to be transmitted is printed as a half-tone picture on a sheet of lead foil.

An insulating substance, such as fish-glue, is used as the printing material. If an electric circuit is completed through a stylus, the picture, and the metal drum it is fitted to, the current would be interrupted whenever the glue came between the stylus and the drum. By rotating the drum and also giving it a longitudinal motion, every part of the picture will come under the stylus at some period. The current passing will be an interrupted one, and may be used at the receiving

end to build up the original illustration.

For reception, a drum with the same motion as the transmitting one has a wrapping of a prepared paper on which a metallic stylus presses. The paper is an electrical conductor and contains an electrolyte, the splitting up of which causes a coloration.

When the currents from the receiving end are passed through the paper, the coloration corresponds to the uncovered part of the transmitted photograph. Whenever there is no current passing, the paper remains plain.

The system has been in use between some of the chief cities of Europe for some years. By using the interrupted currents to actuate a wireless transmitting set, it is possible to use ether waves as the connecting-link between receiver and transmitter. In another form of telautograph devised by J. H. Robertson, the strength of the current is varied according to the curves of the writing, this varied current acting upon the stylus. For a more recent process see TELEGRAPHY (section on *Photo-telegraphy*).

TEL AVIV. A Jewish town near Jaffa, Palestine. Pop. 35,000.

TEL'EDU. A carnivorous mammal (*Mydaus meliceps*), family Mustelidæ, allied to the skunk, and, like it, capable of diffusing a most abominable stench. It is native to Java and Sumatra.

TELEG'RAPHY. The transmission of messages to a distance. The word signifies that the messages are written, but it has been used to denote any method by which signals may be conveyed to a distance, as by the semaphore and by the ship's telegraph. With present-day use, the word implies that the messages are sent by electricity, whether through space (*see* WIRELESS TELEGRAPHY) or by means of conducting lines.

The principle almost universally employed in line telegraphy is that of the electromagnetic action of the current. Attempts to convey intelligence by means of the electric current began about the end of the eighteenth century. In 1820, after Oersted's discovery of the magnetic effect of a current on a compass needle, Ampère suggested that the effect might be employed for the purpose of transmitting signals. Gauss and Wever at Göttingen constructed an electromagnetic instrument by means of which messages were sent a distance of 1½ miles.

The year 1837 saw several important developments in telegraphic instruments. Cooke and Wheatstone introduced a five-needle instrument which, however, required five lines; in America, Morse developed a very complete system of telegraphy; and in Munich, Steinheil employed the earth as a return lead for the current.

The essentials of a telegraphic system are a transmitting mechanism, a line to conduct the current from the transmitter to the receiver, and a receiving mechanism. The diagram (fig. 1) of a simple telegraphic circuit shows the method of connecting these. Each station contains a battery, a key for connecting the battery to the line, a needle instrument the indications of which can be read off by eye, or a sounder which renders the signals audible to the receiving operator.

The key shown is of the Morse type, suitable for use with a sounder, and it is kept in the position shown by a spring. When signals are to be sent from one station to the other, the operator presses the key, and the current flows from the battery along the line to the other station, where it actuates the needle or sounder and flows back to the battery by the respective "earths."

Batteries. The cells used in telegraphy are of the Daniell, bichromate, and Leclanché types; in some cases dry cells are used, and in large offices the current is supplied by accumulators.

Receiving Apparatus. The usual instruments employed in the reception of signals are the needle instrument and the sounder; other instruments have also been used, such as the Wheatstone dial telegraph which spells out the words on an alphabetic dial. In Cowper's telegraph the messages were received in the written form. Morse's printer records the signals, on a paper strip, in the form of dots and dashes; these were originally indented on the paper by means of a point or style, but an ink wheel was substituted by John in 1854 which gave a more legible record.

In Hughes's type-printing machine the words are printed somewhat as in a typewriter. Bain's recording instrument employs the electrolytic effect of the current on a chemically prepared paper.

Single-needle Instrument. This development of Wheatstone's five-needle instrument is a species of galvanoscope, and consists of a vertical needle with coils on each side, through which the current flows. The current may be passed through the coils in either direction

by means of a double tapping-key. These currents deflect the needle to the left or right, a motion to the left representing a dot, and one to the right a dash.

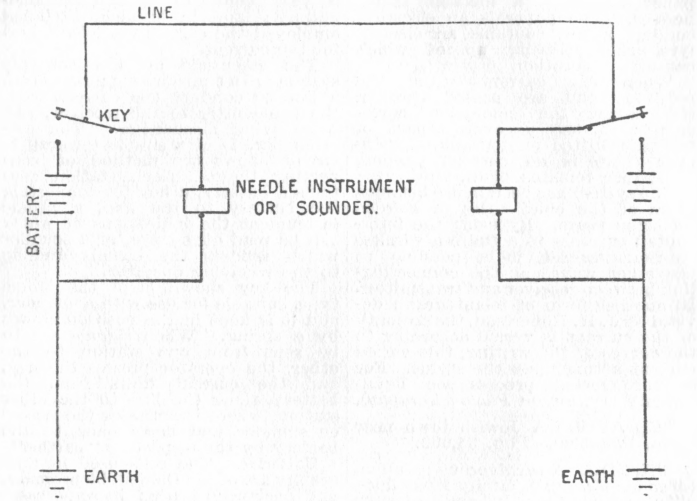


Fig. 1

The instrument is sensitive, but slow in action compared with the sounder; it is widely used on railway telegraph systems. In one form two tin sounders are placed at the sides so that the instrument may also act as a sounder. Permanent magnets are placed in the instrument to prevent the needle from becoming demagnetised.

Sounder. The essential parts of a sounder of the Morse type are (see fig. 2) an electromagnet E, a soft-iron armature A, a lever AB, hinged at H and movable between two stops C and D. The lever is held by the spring S against the stop C until, on a current flowing through E, the armature A is attracted and the lever hits the stop D. When the current ceases, the lever returns to the stop C.

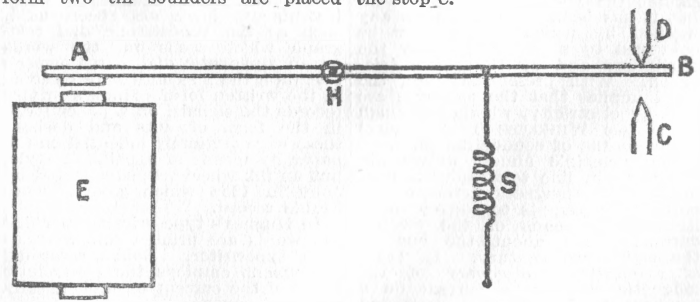


Fig. 2

Sounds are thus made which represent dots and dashes according to the interval between consecutive hits of a stop. No reversal of current is required for this instrument; it is simpler in construction than the needle instrument, and more

rapid in action, but requires a stronger current.

Morse Key. The transmitting key used with a sounder is the Morse key, shown in fig. 1.

Morse Code. The dots and dashes recorded on a Morse printing-machine, or expressed by sounds of short and long duration, are the elements of an alphabetic code of signals. That in common use is the International Code, a modification of Morse's code. By different combinations of dots and dashes the various letters of the alphabet are represented, and it is possible in the case of a skilled operator to send messages by means of these at the rate of thirty to forty words per minute.

Relay. The systems described above cannot be worked at long distances with the usual size of battery, on account of the increase in the resistance of the circuit and the loss of power due to current leakage. A more delicate instrument known as a relay, is consequently introduced into the circuit in place of the signalling instrument. The relay, when acted on by the current from the sending station, closes and opens a local circuit containing a battery and sounder. The action of a relay may be followed from the accompanying diagram (see fig. 4).

The electromagnet E of the relay attracts the armature on the conducting arm AB, thus making contact with the stop C; the local battery circuit is then completed, and the current actuates the sounder S. Relays are distinguished as polarised or non-polarised according as they contain or do not contain permanent magnets; the type used in the British postal service is the polarised relay; it is the more sensitive form.

The Line. The electric current is led between two stations through a bare iron or copper wire suspended from porcelain insulators attached to telegraph poles placed 70 or 80 yards apart. The wire in common use is an iron wire about $\frac{1}{10}$ths of an inch in diameter. Besides being subject to loss of efficiency through current leakage, the working of the lines may be seriously disturbed by the action of storms and of lightning; the latter may fuse the wire, damage the poles and instruments, and endanger the safety of the operators. Magnetic storms, though not capable of causing such great havoc, have been known to upset the working of the lines for several hours.

Duplex Telegraphy. When one line is used to carry messages in both directions, the system employed is known as duplex telegraphy. When two messages are sent through one wire in the same direction, the system used is called diplex. These may be extended to multiplex telegraphy, in which six messages are sent simultaneously along one wire.

Wheatstone's Automatic Telegraph. Besides the methods indicated for

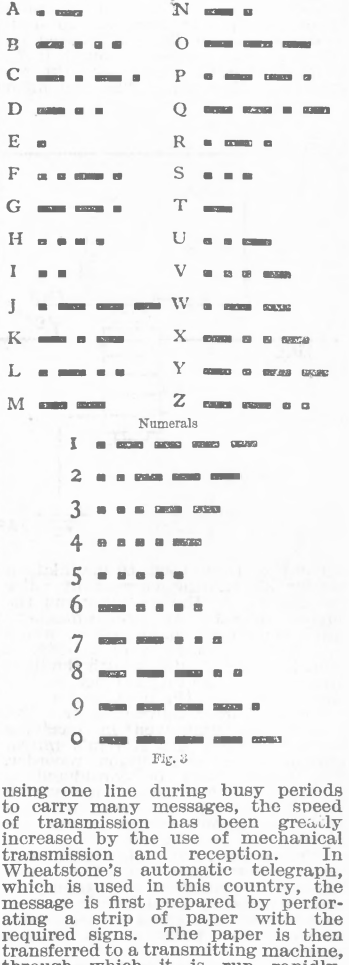


Fig. 3

using one line during busy periods to carry many messages, the speed of transmission has been greatly increased by the use of mechanical transmission and reception. In Wheatstone's automatic telegraph, which is used in this country, the message is first prepared by perforating a strip of paper with the required signs. The paper is then transferred to a transmitting machine, through which it is run rapidly,

and a receiving machine records the signals in ink. The rate of transmission may attain a speed of 450 words per minute.

Photo-telegraphy. Transmission of pictures by telegraphy for reproduction in newspapers has been in regular operation since about 1928. In one system the positive photographic print on celluloid film is placed on a transparent cylinder which can be advanced and rotated. A small spot of light is focused on the film and passes through it to a photoelectric cell (*see* PHOTO-ELECTRIC EFFECT). The amplified current is then used to modulate a carrier alternating current of voice frequency. At the receiving end the current operates an electro-magnetically controlled light valve, which modifies the intensity of a beam of light in correspondence with the light and shade of the original picture, and thus reproduces the photograph.

Kelvin Mirror Galvanometer. The instruments employed in receiving cable messages are Kelvin's mirror galvanometer and siphon recorder. The former may be considered as a very delicate needle instrument (*see* GALVANOMETER), with which a speed of about twenty words per minute can be attained.

Siphon Recorder. This instrument was the first one in which the "moving-coil" principle was used; it was invented by Lord Kelvin in 1867, and consists of a small coil suspended between the poles of an electro-magnet.

As the coil oscillates under the action of the variable current passing through it, it causes an ink-siphon to oscillate across the moving paper strip, on which the siphon pen writes the message in a form of Morse. Automatic transmission is also used on the principal cables. The Hughes printing-machine is employed on the shorter cables, such as those which cross the English Channel. BIBLIOGRAPHY: Sir W. H. Preece and Sir J. Sivewright, *Text Book of Telegraphy*; T. E. Herbert *Telegraphy*; C. Bright, *Submarine Telegraphs*; H. W. Pendry, *Elementary Telegraphy, A Manual for Students*; W. H. Jones, *Telegraphy for Beginners.*

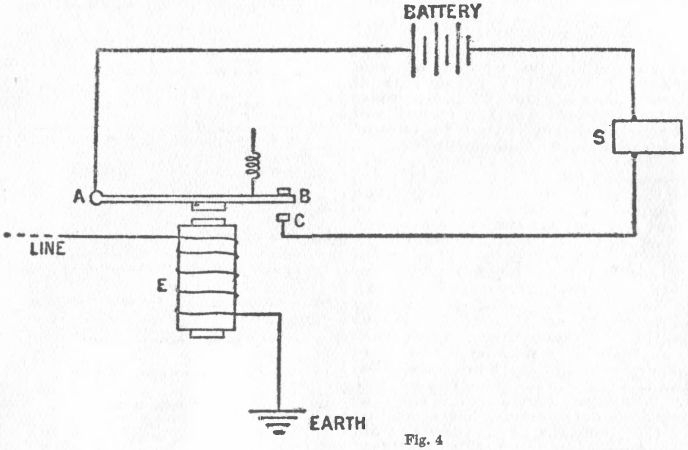


Fig. 4

TELEMACHUS (te-lem'a-kus). In Greek legend, the son of Odysseus (Ulysses) and Penelope, who is reputed to have gone through many adventures in search of his father after the close of the Trojan War. He is the hero of a French prose epic by Fénelon (1699).

TELEOL'OGY (Gr. *telos*, end, *logos*, science). The branch of philosophy which deals with ends and final causes. It also denotes the theory that the world has a design, and that there is a purposed end in it, controlling the course of events. Whilst the phenomena of the universe are determined by efficient causes, and are the result of certain laws, these laws and causes have a directive principle. In other words, the universe and all its phenomena cannot be explained by mechanical principles and the laws of causation.

Most of the Greek philosophers—Anaxagoras, Socrates, Plato, Aristotle, and the Stoics—supported the doctrine. Descartes, Bacon, Hobbes, and Spinoza were opposed to it; but among modern philosophers Leibnitz, Kant, Schopenhauer, Ward, and Bosanquet have written in its favour. The doctrine received a severe backset from Darwin's *Origin of Species*, but certain biologists are once again inclined to advocate the theory.

TELEOS'TEI. A large and important order of fishes, distinguished primarily by the usually *bony* nature of the skeleton as compared with the cartilaginous skeletons of some other sub-classes. Almost all our common fishes are included in this order. *See* ICHTHYOLOGY.

TELEP'ATHY. Communication of impressions of any kind from one mind to another, independently of the recognised channels of sense. It connotes all communications between mind and mind, not only of persons who are at a considerable distance from each other, but also of those who happen to be in the same room, although in the latter case the communication is sometimes termed thought-transference.

In 1876 Professor Sir W. F. Barrett drew attention to the fact that certain persons have the faculty of communicating and transferring ideas and impressions either spontaneously or intentionally, and the Society of Psychical Research has, ever since its establishment, collected and investigated the evidence in favour of telepathy. The term was introduced by Professor Myers in 1882.

The evidence for telepathy consists of either experimental or spontaneous cases. In the former case the "agent" endeavours to communicate an idea or an impression to another person, the "percipient," to transfer a sensation, and even to produce an apparition of himself. In the latter case the "agent" intimates the existence of danger or distress, illness or death to a friend or relative at a distance. Although the evidence for the existence of telepathy seems to be conclusive, the nature of it is still a subject of discussion.

Telepathy has been explained by some as physiological, by others as psychological. Some authorities are in favour of the idea of supernormal faculties, whilst others, like Sir Oliver Lodge, assume the existence of a subconscious mind. Others, however, like the late Sir W. Crookes, prefer a physiological explanation, and look upon the phenomena of telepathy as the result of brain-waves or vibrations connecting mind with mind. *See* PSYCHICAL RESEARCH for Bibliography.

TELEPH'ONY. The transmission of speech to a distance by means of the electric current. The process involves the use of a transmitter into which the message is spoken, a battery, conductors to connect the two stations, and a receiver in which the message is heard. The earliest telephone (1861) was that of Reis of Frankfort; its transmitter consisted of a diaphragm which, in vibrating, made momentary battery contacts, and the receiver was an electromagnet through which the intermittent currents flowed, and in so doing reproduced in some measure the sounds received by the transmitter. This acoustic property of the electromagnet had been demonstrated by Page in America in 1837.

Bell's Telephone. The electromagnetic telephone was invented by

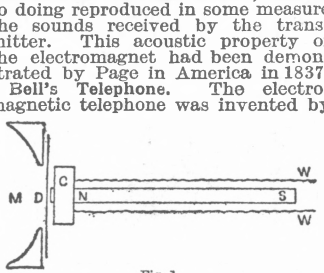


Fig. 1

Graham Bell in America in 1876. It consists of a permanent magnet NS (fig. 1) which carries a coil C at one end. In front of the magnet a thin soft-iron disc D is held with its edge fixed in a holder. The disc vibrates in response to sounds which enter the mouthpiece M; these vibrations cause changes in the distribution of the magnetic field between the magnet and the disc, the latter acting as armature to the magnet; and this in turn sets up changes in the magnetic flux through the coil.

Currents are induced, in the coil, which flow in one direction as the disc approaches the magnet, and in the opposite direction as the disc recedes. These alternating currents are led by the wires ww to a similar instrument, where their magnetic action sets another disc vibrating in the same manner as the first, and the sounds which enter the transmitting telephone are thus repeated in the receiving telephone. As the currents induced in the receiving telephone are feeble, the Bell system is not capable of transmitting speech to any great distance.

The Bell telephone has been modified in several particulars: a horse-

shoe magnet is used instead of a rod; the poles are sometimes supplied with soft-iron ends; and chrom-cobalt steel now permits considerable reduction in the weight of the telephone. The length of the telephone has been shortened by bending the horse-shoe through a right angle, giving the "watch" pattern of telephone; a combination of a pair of this type forms the head-phone used in radio-telegraphy. In the hand-phone as used with a table telephone there is a microphone transmitter and a watch receiver.

Carbon Transmitters. In Edison's transmitter the vibrations of the diaphragm caused changes in the contact between a platinum plate and a carbon plate, between which a current flowed from a battery in the circuit. The variations of resistance which took place in the transmitter gave rise to variable currents which were led to the receiving apparatus. Blake's transmitter differed from that of Edison in having a platinum point pressing against the carbon plate; it gave very clear articulation, but was not so loud as the more modern transmitters.

Hughes's microphone, owing probably to its simpler construction, smaller cost, and high efficiency, has displaced the Edison transmitter (*see* MICROPHONE). Hunnings used a number of small carbon granules between the vibrating diaphragm and the carbon plate, and this form of transmitter, fitted with a device for preventing the granules from becoming tightly packed, is used at the present day.

Telephone Circuits. The arrangement of battery, instruments, and connecting wires is known as the telephone circuit, and in the case of a large system the complete circuit becomes a complicated network. A simple domestic telephone circuit can be formed by adding two telephones of the hand-phone type to an electric bell circuit; such a circuit, with transmitter and receiver in series with the battery, belongs to what is known as the direct-working system.

Transformers. The direct-working system is not applicable to large systems of lines, for the changes in a given microphone would cause current changes which would give strong signals on short lines and weak signals on long lines. Transformers are therefore employed in order to make the strength of the received signals independent of the resistance of the line.

The sounds spoken into the microphone M (fig. 2) set up current variations in the primary coil P in the microphone circuit; these induce currents of higher voltage in the secondary coil S of the "step-up" transformers or induction coil PS, and these induced currents actuate the telephone T at the receiving end of the line. The process can be carried out in the reverse direction.

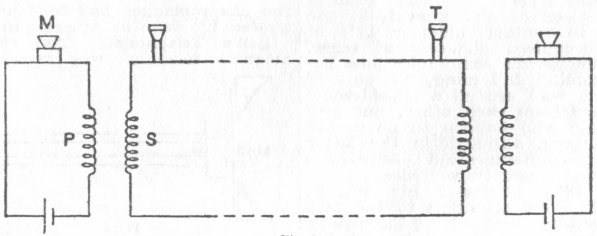


Fig. 2

Telephone Exchanges. In order that the different members of a telephone system may be able to communicate with one another, wires are led from each instrument to a central office or exchange, where they terminate on a switchboard. The exchange operator, on being called, can connect any two lines as may be required.

Current. The current for telephones is provided either by means of a magneto or by a battery. The magneto is a small alternating-current machine run by turning a handle. Current is required for ringing the bell and for use while speaking.

It is common practice in telephone systems to use one battery as a source of current for all subscribers, this method of distributing current being called the common battery system. The battery, generally a storage one, is placed in the exchange, and when a receiving instrument is taken off its hook, the battery informs the exchange operator of this fact by working an indicator.

Intercommunicating Telephones. In factories, public buildings, and large offices where much time may be spent in moving from one department to another, a telephonic system can be set up which enables each telephone to communicate with any other telephone on the system. This requires as many wires as there are instruments; and one wire is used as a common return. Junction boxes near each instrument allow access to all the wires, and by means of a many-way switch one instrument can be connected to any other instrument desired. It is necessary, in this system, to replace the switch lever on the common stud.

Automatic Systems. In the newest telephone systems the return of the circuit to its normal condition, so that it is ready to receive another call, is accomplished automatically when the hand-phone is replaced, at the end of a conversation. The selector switch is used only when calling up. When ringing up, the depression of the bell-push also disconnects the receiver from the "home line," thereby preventing disturbance from other callers. To receive a call, all that is necessary is to remove the receiver, place it to the ear, and begin the conversation.

The automatic principle has made considerable progress since the beginning of the present century; it remains to be seen whether the principle is applicable on a large scale. Automatic exchanges are in course of erection in many towns, and the experience gained in working these will, no doubt, determine to what extent the automatic exchange can profitably supersede the older system.

Sensitiveness of the Telephone. Much of the success attained in telephony, and also much of the disturbance experienced by users of the telephone, may be ascribed to the remarkable sensitiveness of both transmitter and receiver. Hughes's microphone is said to be affected by the walking of a fly over it, and it has been stated by Lord Rayleigh that a current of about four hundredths of a microampere can be perceived in the telephone; other observers have given even smaller values for this minimum current.

Long-distance Telephony. Communication between one town and another takes place over "trunk" lines, or cables which are laid double in order to prevent inductive disturbances. The British Post Office is gradually laying a network of trunk circuits so that telephonic communication may be made possible between the remotest towns in the three kingdoms. On 31st March, 1932, there were in Britain 18,050 Inland trunk and 121 International circuits, the latter including 4 transatlantic, 1 Australian, 1 South American and 1 South African. In America the telephone has been used between New York and San Francisco, a distance of about 2500 miles.—BIBLIOGRAPHY: F. C. Allsop, *Telephones, their Construction and Fitting*; Preece and Stubbs, *Telephony*; Herbert, *Telephone System of British Post Office*; J. Poole, *Practical Telephone Handbook*; Webb, *The Telephone Service.*

TELEPHOTOGRAPHY. Long-distance photography. The photographing of distant objects by ordinary photographic methods is rendered unsatisfactory by atmospheric moisture which diffuses the rays of visible light and produces the blurred effect of normal vision. Long-distance photography, however, can now be achieved, with or without the use of a telescopic lens, by using only the infra-red rays, which are less easily diffused and so travel in a more direct line than visible rays from the object to the lens, thus giving a sharper definition. For this purpose a special filter is used which cuts out all but the infra-red rays, while the exposure is made on a plate particularly sensitive to these rays. In this way details of landscape, etc., which are obscured by haze to normal vision, can be rendered clearly in a photograph.

TEL'ESCOPE. An optical instrument essentially consisting of a set of lenses, or mirrors and lenses, fixed in a tube or a number of sliding tubes, by which distant objects are brought within the scope of distinct, or more distinct vision. There are two ways in which the telescope may assist human vision. The light entering the pupil of the eye from a luminous body of no appreciable apparent size, and received upon the retina, may be too little to affect sensibly the optic nerve.

The telescope substitutes for the human eye its large object lens, or its reflector, which collects and transmits to the eye a larger amount of light in proportion to the area of its light-gathering surface, and this increased light may be adequate to ensure perception.

Again, the surface of any object presented towards the unaided eye may be regarded as projected upon a large sphere, having the eye for its centre, and its apparent area is

measured by the proportion of the entire surface of that sphere which it would occupy.

When the distance is great, this angular area becomes too small to convey to the retina any sensible impression, even if the surface luminosity of the object is considerable. In this case the telescope aids the eye by magnifying the image of the object, so as to bring its angular area above the limit of visibility.

The *refracting telescope* is constructed of lenses which by successive refractions produce the desired effect. In fig. 1, which illustrates this

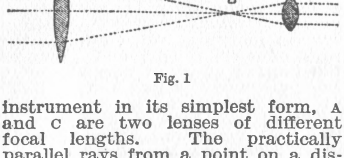


Fig. 1

instrument in its simplest form, A and C are two lenses of different focal lengths. The practically parallel rays from a point on a distant object, falling up the object-glass A, converge to a point at B, in its focal plane. The eye-glass C, placed at about its focal length from B, gathers up the diverging rays and carries them to the eye. Its effect is to magnify the image of the object formed in the focal plane of A (*see* OPTICS).

The magnifying power of the instrument is approximately AB/CB, or the ratio of the focal length of the object-glass to that of the eye-glass. The composite nature of light, and the fact that rays of different colour or wave-length undergo different amounts of refraction, cause the diverse rays falling upon a single lens to converge upon different foci. Thus a blurred and coloured image is produced.

Formerly, in order to minimise the *chromatic aberration*, object-glasses were made of great focal length in relation to their diameter. The telescope had thus to be very long and unwieldy. Now the difficulty is overcome by using an object-glass made up of two lenses, a convex lens of crown glass and a concave lens of flint glass (*see* ACHROMATIC). For the same and other reasons the eye-piece also consists of two lenses of one or other of certain particular forms and arrangements.

In the astronomical refracting telescope the object is seen inverted. For observing terrestrial objects this would be unsuitable; therefore when the telescope is so employed, a terrestrial eye-piece containing two additional lenses and giving erect images is used.

In the *Galilean telescope* the eye-piece is a concave lens placed so as to intercept the rays from the object-glass before reaching the focus. This gives an erect image, but a small field of view. It is now used practically only for opera-glasses and field-glasses.

The *reflecting telescope* was devised in order to get rid of the trouble of chromatic aberration, and is still found to be a specially advantageous form of instrument for many purposes. In it the object-glass is replaced by a concave mirror. As rays of different colours are not separated by reflection, the image formed by this mirror is free from the colour defect. Fig. 2 shows the structure of the reflecting telescope of the *Gregorian* form. AB is a large speculum perforated in the centre; *ba* and *dc* are two of the rays from a distant object, which are reflected to a focus at *e*. A small concave speculum C, placed slightly beyond the focus *e*, intercepts the reflected rays and sends

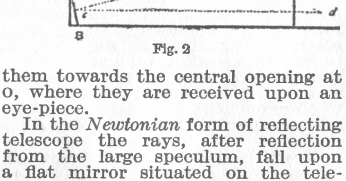


Fig. 2

them towards the central opening at O, where they are received upon an eye-piece.

In the *Newtonian* form of reflecting telescope the rays, after reflection from the large speculum, fall upon a flat mirror situated on the telescopic axis and fixed at an angle of 45°. This reflects them to the side of the tube, where the eye-piece is placed to receive them.

In the *Herschelian* telescope the speculum is slightly inclined, so that its optical axis makes a small angle with the axis of the telescope tube. The image is thus formed at the open end or mouth of the tube at one side, and is here viewed through an eye-piece, so that the observer has his back towards the object under examination. Formerly the mirrors of reflecting telescopes were made of "speculum metal," a composition consisting of two-thirds of copper and one-third of tin.

For the mirrors of modern reflectors a piece of glass is accurately ground to the required shape. Upon the curved front of this is deposited a

thin film of silver, which forms the reflecting surface. This has the great advantage that it can be renewed from time to time, without necessitating a repetition of the original figuring process.

The Lick and Yerkes Observatories, in the United States, possess the largest refracting telescopes in the world, the diameters of the object-glasses being 36 and 40 inches respectively. At Meudon, Paris, there is a refractor of 32·6 inches aperture. The largest instruments are, however, reflecting telescopes.

The Dominion Observatory, Victoria, British Columbia, has a mirror of aperture 72 inches, a size the same as in the famous telescope of Lord Rosse at Parsonstown, in use last century. Mount Wilson Observatory, California, has two reflecting telescopes, the apertures of which are 60 inches and 100 inches.

TELEVISION. Transmission by electrical means of representations of events at the time they occur. One successful method breaks up the whole scene into a series of points of light, which by means of photo-electric cells, are converted into electric currents, amplified and transmitted. At the receiving end, the electric signals are converted into light, the varying intensity of which, when symmetrically arranged as at the transmitting end, gives a representation of the scene.

The greatest principles required for the accomplishment of television were known as long ago as 1884, but success was not achieved till the perfection of devices for amplifying currents. J. L. Baird, in Britain, and C. F. Jenkins, in America, exhibited television apparatus in 1925; in 1927 the American Telephone and Telegraph Co. gave a public demonstration over a long distance, and in 1928 Baird transmitted images across the Atlantic, and in colour. Since 1932, television programmes have been broadcasted by the B.B.C.

TELFORD, Thomas. British engineer, born in 1757 in Eskdale, Dumfriesshire; died in 1834. He was a mason to trade, and worked for some time in Edinburgh, but settled in London in 1783. He proved himself to be a very efficient foreman builder, and in 1787, through the good offices of Sir William Pulteney, who had known him in Dumfriesshire, he was appointed surveyor of public works in Shropshire.

He now exchanged his original occupation for that of civil engineer, and was entrusted with the construction of the Ellesmere Canal. In the years 1803 and 1804 the parliamentary commissioners for making roads and building bridges in the Highlands of Scotland, and also those for making the Caledonian Canal, appointed Telford their engineer, and thus an immense amount of work was carried out by him.

Above thirty harbours were built or improved by him, some of which, as at Aberdeen and Dundee, were upon an extensive scale. He also superintended the construction of five large bridges over the Severn, and the laying down of the Gloucester and Berkeley, the Grand Trunk, Birmingham and Liverpool, and the Macclesfield Canals. In 1808 he was employed by the Swedish Government to lay out a system of inland navigation through the central parts of that kingdom, which ultimately formed a direct communication by water between the North Sea and the Baltic.

The greatest monument of his engineering skill, however, was the Menai Suspension Bridge, connecting Carnarvonshire with the Island of Anglesey, opened in 1826. The Conway Bridge was also built by him, as well as the Dean Bridge, Edinburgh, and the Broomielaw Bridge, Glasgow. He was buried in Westminster Abbey.—Cf. S. Smiles, *Lives of the Engineers.*

TELL, William. A legendary national hero of Switzerland. He is said to have belonged to the canton of Uri, and to have united with others in resisting the Austrians. In particular, having refused to do homage to the hat of the Duke of Austria, which Gessler, the duke's bailiff, had set upon a pole, he was seized and condemned to death, but granted his life on condition of shooting with an arrow an apple placed on the head of his own son.

This he did successfully, admitting at the same time that a second arrow he had was intended for Gessler in case of failure. He was therefore still kept a prisoner; but while being conveyed over the Lake of Lucerne he managed to leap ashore, and soon after, having lain in wait for Gessler, he shot the tyrant dead. The stories professedly belong to the end of the fourteenth or early part of the fifteenth century. The most famous version of the story of Tell is Schiller's drama *Wilhelm Tell. Guillaume Tell* is the name of an opera by Rossini.

TELL AL-AMARNA. An extensive group of ruins on the right bank of the Nile, near Haggi Kandîl, 196 miles from Cairo. The name is derived from the Beni Amran, a

nomadic tribe of the district, and the *Tell*, meaning "a hill," is a solecism. Tell al-Amarna is the site of the ancient Egyptian city of Akhetaten, which was founded in 1370 B.C. by Amenhotep IV., the father-in-law of Tutankhamen (q.v.).

Amenhotep conceived a violent dislike for Amen-Ra and the whole pantheon of miscellaneous Theban deities with their attendant priesthood, and substituted for the old polytheistic form of worship a monotheistic cult of the sun, which was worshipped as a Disk.

Amenhotep changed his name to Akhenaten, or "spirit of Aten," *Aten* being the Disk of the Sun, and throughout his reign the sun cult persisted. Among excavators have been Flinders Petrie (1891), who unearthed the Royal Palace and the Temple of the Disk; the Deutsche Orient Gesellschaft (1910-4); and the Egypt Exploration Society (1920-1).

TELL-EL-KEBIR'. A village of Egypt, near the railway from Cairo to Ismailia and the Freshwater Canal, where the British troops under Wolseley defeated those of Arabi Pasha, 13th Sept., 1882.

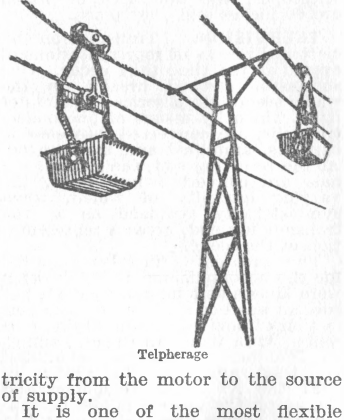
TELLICHERRY. A seaport of India, in the Malabar district of the province of Madras. It is the third port of Malabar, and is a mart for sandalwood, pepper, and coffee. Pop. 27,576.

TELLURIUM (symbol, Te; atomic weight, 127·5). A rare element discovered by Klaproth in 1798. It belongs to the sulphur group of elements, and shows a considerable resemblance to sulphur and selenium, although it is usually classed as a metal. It is found in certain gold ores in Transylvania and Hungary, occasionally native, but mostly associated with other elements, for example, in *bismuth telluride* or *tetradymite*, Bi_2Te_3 (California), *lead telluride* or *altaite*, PbTe (America), and in arsenical pyrites.

Considerable quantities of tellurium are obtained from the sludge in electrolytic cells in the refining of copper. It occurs in allotropic modifications, a crystalline, brittle form resembling bismuth, and a black amorphous form. The element melts at 450° C., and burns in air, forming tellurium dioxide, TeO_2. The oxides correspond to those of sulphur, e.g. TeO_2 corresponds to sulphur dioxide, SO_2. It forms a gaseous compound with hydrogen, *telluretted hydrogen*, TeH_2, which has an exceedingly unpleasant odour and unites with metals forming *tellurides*, corresponding to the sulphides.

All compounds of tellurium when fused with potassium carbonate and carbon, and then treated with water, yield a characteristic purple solution. The atomic weight of tellurium is interesting, as it is higher than that of iodine, although iodine comes after tellurium in the Periodic Table (q.v.).

TELPHERAGE. A system of handling goods in works, and conveying them from one part to another at high speed. In the usual arrangement an electric supply is provided by a trolley wire, or, where permissible, by one of the girders from which the carrier is suspended; and similar equipment is installed for the return of the electricity from the motor to the source of supply.



Telpherage

It is one of the most flexible systems of handling any material in bulk or in containers, and admits of great extension. It is not confined in use to any particular industry, for the only changes in design which are needed to adapt it to any type of work are in the form of the carrier, which may be replaced by a grab or crane hook. In ordinary practice light loads are dealt with by a carrier suspended from the bottom flange of an I beam, but heavy loads may necessitate the use of taper strips on the beam, or, in cases where high speeds are essential, the car may be run on tracks suspended from the beam.

The system is most satisfactory when arranged in horizontal runs, but small gradients, such as those up to 1 in 50, can be operated suc-

cessfully. It is preferable to use a direct-current supply, because of the simplicity of the collecting gear and track switches compared with those necessary with alternating currents. If a rail is used for the return, it should be bonded, that is, copper connections across the joints should be provided.

TELU'GU, or TELINGA. One of the languages of India, belonging to the Dravidian group, and spoken in Southern India by over twenty millions of people. The Telugu are the most numerous branch of the Dravidian race, but are less enterprising than the Tamils. The language is allied in roots to the Tamil language.

TEM'BULAND. A district of the Cape Province, Union of South Africa. It adjoins Pondoland and Griqualand East; chief town, Umtata. Area, 3339 sq. miles; pop. (European, 1931), 5356.

TEMPÊ, VALE OF. A beautiful valley of Northern Greece, in Thessaly on the Peneus, much celebrated by the ancient poets, having Mount Olympus on the north and Mount Ossa on the south.

TEMPERANCE LEGISLATION. Legal measures for the prevention of intemperance. In 1551-2 there was passed a *Licensing Act* which had as its chief aim the prevention of drunkenness. It regulated and reduced the hours during which liquor might be sold on Sundays, and instituted penalties on innkeepers who permitted upon their premises the playing of games of chance, traffic in stolen goods, and the resorting of idle and notoriously dissolute persons.

Another measure on behalf of temperance was the *Gin Act* (1736), the cheapness and popularity of that particular spirit having produced appalling scenes of degradation. The price of gin was raised by increased taxation; but the measure was a failure, and the chief result was a great increase in illicit trade.

The *Beerhouse Act*, or *Duke of Wellington's Act* (1830), modified in 1834 and 1840 and repealed in 1869, removed from the control of the local justices houses in which only beer was sold. During the latter half of the nineteenth century all proposed temperance legislation received warm support from, and was largely initiated by, Sir Wilfred Lawson, who was returned to Parliament as member for Carlisle (1859).

In 1864 he unsuccessfully introduced his *Permissive Bill*, by which a two-thirds majority in any district would have had the right to local veto. During the European War the autocratic powers acquired by the Government permitted the exercise of a control hitherto unparalleled over the sale of intoxicating liquors, and this was not entirely relaxed after the Armistice. The Report of the Royal Commission on Licensing, issued in 1931, was received with satisfaction by the leaders of the movement, at least so far as its findings are concerned, though disappointment was expressed at its recommendations for legislative reform. *See* PROHIBITION.

TEMPERANCE SOCIETIES. The first association for the purpose of influencing public opinion in order to check the evil of intemperance appears to have been formed in Massachusetts in 1813. A year after its formation similar associations were formed in Connecticut and Vermont. In 1826 a new impulse was given to the movement by the establishment in Boston on a more extensive plan of the American Society for the Promotion of Temperance. By 1831 more than 2200 societies, embracing 170,000 members, were in correspondence with the parent society.

In Aug., 1829, a society was formed in Ireland, and in 1838, a great impetus to the movement was given by the Rev. Theobald Mathew, an Irish Catholic priest. The first temperance society in Scotland was established at Maryhill, near Glasgow, in Oct., 1829, and the Greenock and Glasgow and West of Scotland Temperance Societies were constituted soon afterwards. On 14th June, 1830, the first temperance society in England was founded at Bradford.

In 1817 a total abstinence society was formed at Skibbereen, County Cork; it was followed by the formation of a similar society in Dunfermline in 1830, and that by others in Paisley, Glasgow, Greenlaw, and elsewhere.

In 1832 the war against intoxicating liquors of all kinds was opened in England by Joseph Livesy of Preston. Since then many advocates of total abstinence have sought to enforce their views by legislative measures, as long ago exemplified in the celebrated Maine Liquor Law, for the suppression of the manufacture and sale of intoxicating beverages in the state of Maine. Legislation has since been in favour of compulsory abstinence, especially in the United States (*see* PROHIBITION).

Among the principal temperance societies in Great Britain—besides the

world-wide Independent Order of Good Templars, which originated in America—are the National Temperance League, founded in London in 1856; the Scottish Temperance Alliance; the Irish Temperance Alliance; the Church of England Temperance Society, organised in 1873; societies in connection with the Established Church of Scotland, and Protestant Episcopal Church in Ireland, and with the various Dissenting bodies throughout the kingdom; the Band of Hope Union; etc. Other national societies are principally benefit societies, among the chief of which are the Sons of Temperance, the Independent Order of Rechabites, and the Sons of Phœnix.

TEMPERATURE. The state of a body with respect to sensible heat. To say that one body is at a higher (or lower) temperature than another is the same thing as to say that the first body is hotter (or colder) than the other.

Since many physical phenomena take place at definite temperatures, it would be quite possible to construct a scale of temperatures containing no very wide gaps, and marked with such definite points as the melting- and boiling-points of standard substances under stated pressures. It is found more convenient, however, to define a continuous scale, based on some physical property which varies continuously as the temperature changes. *See* THERMOMETER; PYROMETER; THERMODYNAMICS; CLIMATE; METEOROLOGY.

TEMPEST, Marie Susan. English actress. She was born in London, 15th July, 1866, and educated at the Ursuline convent at Brildonck, Belgium. Her first stage appearance was as Fianetta, in Boccaccio. She has toured in Canada, the United States, Australia, New Zealand, South Africa, Pekin and Manilla, and has produced plays by Arnold Bennett, Harold Chapin, Jerome K. Jerome, Henry Arthur Jones, Robert Marshall, etc. She gave up musical plays in 1900, and turned to comedy.

TEMPLARS. A military Order which played a large part in European history in the twelfth and thirteenth centuries. It was founded in 1119 to guard the holy places, and its name was derived from its first house in Jerusalem, on the site of Solomon's Temple. The members were sworn to chastity, poverty, and obedience, and their vows might be taken for life or for a period of years.

The head of the Order was the Grand Master, and, as it spread from country to country, Masters, Grand Priors, Preceptors, or Commanders were placed in charge of the various provinces. The Templars were exempted in 1172 from obedience to the bishops of their dioceses, and were placed under the direct authority of the Pope.

The dress of the Order, worn by the Knights (though not by the lesser ranks of men-at-arms and retainers), was a white linen mantle with a red cross on the left shoulder. Its statutes, originally drawn up in 1128, forbade luxury in food or drink, and such sports as hunting and hawking. The Templars played a distinguished part in the Crusades, and it is said that 20,000 of them met their death in Palestine.

Templar

They became numerous and wealthy, and, as early as the second quarter of the thirteenth century, grave charges were brought against them. The popular impression of their pride, lust, and rapacity is described (and perhaps somewhat antedated) by Scott (*Ivanhoe*). After the close of the active period of the Crusades, the Order ceased to have any *raison d'être*, and its wealth and privileges roused jealousy and ill will.

Its suppression was one of the most remarkable episodes in the history of the fourteenth century. Philip IV. of France resolved to enrich himself with their possessions, and he obtained the consent of Pope Clement V., whom he had placed on the Papal throne. The French Templars were arrested on 13th Oct., 1307; many of them were put to the torture, and evidence of outrageous heresies and grave moral offences was extracted from some of them.

In 1308 Clement ordered the Templars in every country of Europe to be subjected to an interrogation, accompanied by torture. The proceedings were marked in France by great cruelty. A General Council was summoned to meet in Vienne to consider the results of the investigation, but Clement ultimately condemned the Order out of hand by Bulls, *Vox in excelso* and *Ad providam*, issued in 1312.

Strong Papal pressure was used to obtain a condemnation in England; and in Spain, Portugal, Germany, and the greater part of Italy the decision of the investigators was in favour of the Order. The suppression was, however, universal, and much of the property of the Templars passed to the military Order of the Hospitallers of St. John of Jerusalem, though, in France, Philip IV. secured considerable gains.

The memory of the Templars is preserved in numerous place-names. The question of their guilt is one of the puzzles of history, and has given rise to a vast amount of literature, but, on the whole, discussion tends to the exculpation of the Order.—BIBLIOGRAPHY: C. G. Addison, *History of the Knights Templars*; H. C. Lea, *History of the Inquisition*, vol. iii.

TEMPLE, Frederick. British prelate, born in 1821, died in 1902. Educated at Tiverton and Balliol College, Oxford, he became a Fellow of his college. He took orders in 1846, was appointed principal of Kneller Hall Training College in 1848, and in 1858 became headmaster of Rugby School. Appointed Bishop of Exeter in 1869, in spite of great opposition, he was transferred to the see of London, and in 1896 succeeded E. W. Benson as Archbishop of Canterbury.

TEMPLE, Sir William. English statesman, born in 1628, died in 1699. Educated at Emmanuel College, Cambridge, he passed six years abroad, and in 1660 he was nominated as one of the commissioners from the Irish Parliament to the king, subsequently 1666) being appointed Resident at Brussels, and receiving a baronetcy.

In conjunction with De Witt he concluded the treaty between England, Holland, and Sweden (Triple Alliance, 1668), as a result of which France had to surrender her conquests in the Netherlands. After representing the University of Cambridge in Parliament, Temple retired from public life (1681), spending his life at Moor Park, Surrey, where Swift was an inmate of his house for some time.

His *Memoirs and Letters* are especially interesting to the student of history. His *Miscellanies* consist of essays on various subjects, mostly political; he was the author of an essay, *Upon the Ancient and Modern Learning*, which gave rise to the celebrated controversy about the *Letters* of Phalaris. *See* BENTLEY.—Cf. M. L. R. Beaven, *Sir William Temple* (Gladstone Essay, Oxford, 1908).

TEMPLE (Lat. *templum*). In architecture, a building designed for the performance of public worship. Magnificent temples were erected in ancient Greece and Rome, the Romans taking the Greek structures for models. (For description of Grecian temples, see GREECE.) The Egyptian temples were also remarkable structures. (*See* EGYPT.)

The most remarkable temple in the world, however, was that built by Solomon on Mount Moriah in Jerusalem. It was an oblong stone building, 60 cubits in length, 20 cubits in width, and 30 cubits in height. On three sides were corridors, rising above each other to the height of three stories. The fourth or front side was open, and was ornamented with a portico, 10 cubits in width, supported by two brazen pillars.

The interior was divided into the most holy place, which contained the ark of the covenant, and was separated by a curtain from the sanctuary, in which were the golden candlesticks, the table of the shew-bread, and the altar of incense. The temple was surrounded by an inner court, which contained the altar of burnt-offering. Colonnades, with brazen gates, separated this court of the priests from the outer court, which was likewise surrounded by a wall. This temple was destroyed by the Assyrians, and, after the return from the Babylonian captivity, a second temple, but much inferior in splendour, was erected.

Herod the Great rebuilt it of a larger size, surrounding it with four courts, rising above each other like terraces, the lowest of which was 500 cubits square, and was surrounded on three sides by a double, and on the fourth by a triple row of columns.

In the middle of this enclosure stood the temple, of white marble richly gilt, 100 cubits long and wide, and 60 cubits high, with a porch 100 cubits wide. This magnificent edifice was destroyed by the Romans in A.D. 70. *See* PANTHEON; PARTHENON.

TEMPLE, THE. A district of the city of London, lying between Fleet Street and the Thames, and divided by Middle Temple Lane into the Inner and the Middle Temple belonging to separate societies (*see* INNS OF COURT).

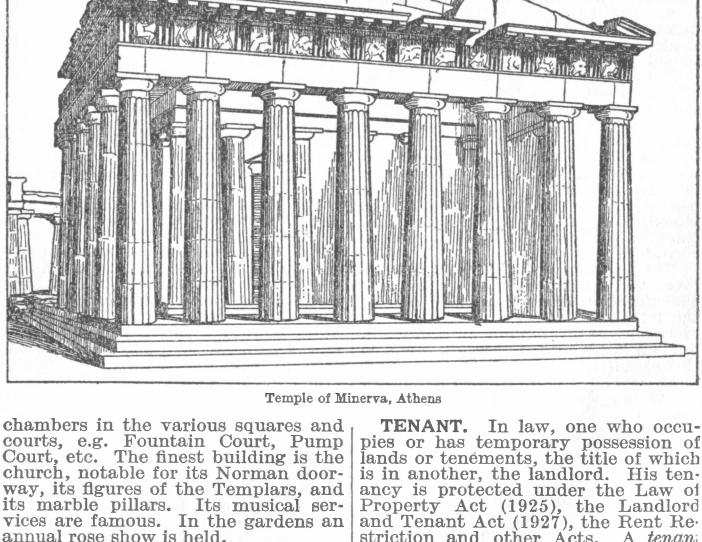
The building includes the two halls, that of the Middle Temple, dating from 1572, the libraries, and the chambers in the various squares and courts, e.g. Fountain Court, Pump Court, etc. The finest building is the church, notable for its Norman doorway, its figures of the Templars, and its marble pillars. Its musical services are famous. In the gardens an annual rose show is held.

The name is derived from the Knights Templars, who had their headquarters in England here. The district, which is extra-parochial, being exempt from the operation of the poor law, is occupied, with few exceptions, entirely by barristers and solicitors.

TEMPLE BAR. An arched gateway which formerly stood between Fleet Street and the Strand in London and divided the City from Westminster. It was removed (1878), and re-erected at Theobalds Park, Cheshunt, in 1888. The gateway was designed by Wren to replace an old one on which the heads of traitors were exposed.

TEMPLET. A pattern or mould used by masons, machinists, smiths, shipwrights, etc. It usually consists of a flat thin board, a piece of sheet-iron, or the like, whose edge is dressed and shaped to the required conformation, and is laid against the object being moulded, built, or turned so as to test the conformity of the object thereto.

TEMRYUK. A port of Ciscaucasia, in Kuban. Pop. 17,700.

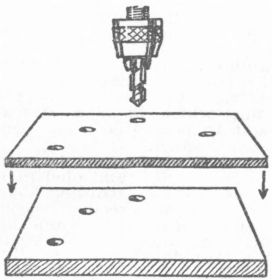


Temple of Minerva, Athens

TENANT. In law, one who occupies or has temporary possession of lands or tenements, the title of which is in another, the landlord. His tenancy is protected under the Law of Property Act (1925), the Landlord and Tenant Act (1927), the Rent Restriction and other Acts. A *tenant at will* is one who occupies lands or tenements for no fixed term. The tenancy may be determined at any time by either party on giving notice. A *tenant in common* is one who holds lands or tenements along with another or other persons.

Each share in the estate is distinct in title, and on the death of a tenant his share goes to his heirs or executors. It can exist, in equity only, now, or in the proceeds of land held in trust for sale. A *tenant for life* (in Scotland a *life-renter*) is one who has (since 1926) vested in him a fee

simple on the trusts of a settlement by which he takes an equitable interest for life. An estate for life is created by deed (*see* LANDLORD AND TENANT).—Cf. Woodfall, *Law of Landlord and Tenant.*



Templet

TENANT-RIGHT. A term specifically applied to an Irish custom, long prevalent in Ulster, either ensuring a permanence of tenure in the same occupant without liability to any other increase of rent than may be sanctioned by the general sentiments of the community, or entitling the tenant of a farm to receive purchase-money amounting to so many years' rent, on its being transferred to another tenant; the tenant having also a claim to the value of permanent improvements effected by him.

In course of time the advantages of tenant-right granted to the Ulster farmers were claimed by the farmers in the other provinces of Ireland, and the custom spread to a considerable extent. At last the Landlord and Tenant Act of 1870 was passed, by which the Ulster tenant-right and other corresponding customs received the force of law; and the outgoing tenant became entitled to compensation from the proprietor to an amount varying according to circumstances.

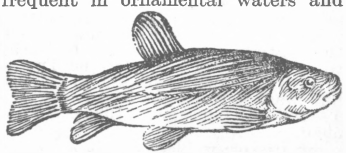
The tenant's position was further improved by the Land Law Act, 1881, and subsequent Acts. (*See* IRELAND.) In Great Britain also the position of agricultural tenants has been improved by legislation, more particularly by the Agricultural Holdings Act of 1908 (consolidating earlier statutes), which assures tenants of certain customary rights and expressly adds others, especially the right of compensation for definite improvements made in their holdings.

TENAS'SERIM. A maritime division of Lower Burma, conterminous on east and south with Siam and Malaya respectively. There are six districts, viz. Toungoo, Salween, Thaton, Amherst, Tavoy, and Mergui. Area, 35,886 sq. miles; pop. 1,429,000 (mainly Buddhists). The adjacent islands of the Mergui Archipelago belong to the division. Moulmein is the headquarters.

TENBURY. A town of Worcestershire, England, on the Teme, 19½ miles from Worcester. It has medicinal springs, and the town is sometimes called **Tenbury Wells.** St. Michael's College, founded in 1857 for the study of church music, is 2 miles distant. Pop. (1931), 1922.

TENBY. A municipal borough and seaport of Wales, in the county of Pembroke, on the west side of Carmarthen Bay. Tenby is a bathing-place, celebrated for its sands, beautiful scenery, and agreeable climate. There is a harbour for the fishing. Objects of interest are the walls and gateway of the old fortifications, and the remains of the castle. Pop. (1931), 4108.

TENCH. A teleostean fish belonging to the carp family and genus Tinca, of which *T. vulgāris* (the common tench) is the type. It inhabits most of the lakes of the European continent, and in Britain it is frequent in ornamental waters and



Tench

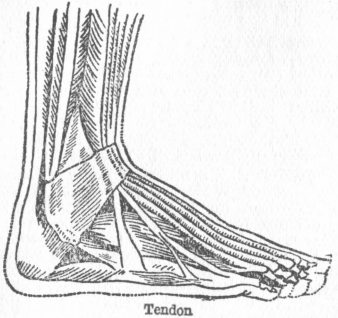
ponds. It attains a length of from 10 to 12 inches.

The colour is generally a greenish-olive above, a light tint predominating below. It is very sluggish, apparently inhabiting bottom-waters, and feeding on refuse vegetable matter. It is very tenacious of life, and may be conveyed alive in damp weeds for long distances. The flesh is somewhat coarse and insipid.

TENDER. In law, an offer of compensation or damages made in a money action. To make a tender valid it must be absolute and unconditional, and the money must be actually produced. A tender made to one of several joint claimants is held as made to all. A tender of money for any payment is legal, and is called a *legal tender* (q.v.), if made in current coin of the realm.

TENDON. The name given to the "sinews" by means of which muscles are inserted upon bones. They con-

sist of bundles of white fibrous inelastic and very strong tissue disposed in bands, and separated by areolar or connective tissue. *See* ACHILLES' TENDON.



Tendon

TENEB'RIO. A genus of beetles. The larvæ of one species (*T. molitor*) are the destructive meal-worms of granaries, flour-stores, etc.

TEN'EDOS. A Turkish island in the Ægean Sea, on the west coast of Asia Minor, 15 miles south-west of the Dardanelles, about 6 miles long; area, 16 square miles. Corn, cotton, wine, and fruits are produced. On the eastern side of the island is the town of Tenedos. Under the Treaty of Sèvres, Tenedos passed to Greece, but was restored to Turkey by the Treaty of Lausanne (1923). Pop. 5050.

TENERIFFE'. The largest of the Canary Islands (q.v.); area, about 785 sq. miles. Santa Cruz is the island and group capital. A remarkable feature of the interior is the Peak, the summit of which forms a crater half a league in circuit, and from which is obtained one of the most magnificent views in the world. It has a broadcasting station (41·6 m., 0·05 kw.). The principal productions are: maize, wheat, potatoes, tomatoes, bananas, almonds, oranges, guavas, honey, wax, cochineal, and wine. Tomatoes, bananas, potatoes, and wine are the chief exports. Pop. 150,000.

TENES'MUS. Continued painful efforts to empty the rectum or the bladder, produced by spasmodic contractions of these organs. The rectal condition may occur as the result of piles, fissure, fistula, or tumour growths. Tenesmus of the bladder arises in cases of stricture of the urethra, and of stone or growth in the bladder, or any inflammatory condition in the region of the bladder.

TENIERS (ten-ērs'), **David.** The name of two artists of the Flemish school, father and son, both natives of Antwerp, in which city the elder was born in 1582, and died in 1649. Having studied under Rubens, he spent six years in Rome. On his return he occupied himself principally in the delineation of fairs, rustic sports, and drinking parties, which he exhibited with such truth, humour, and originality that he may be considered the founder of a style of painting which his son afterwards brought to perfection. His pictures are mostly small.

His son, **David Teniers,** the younger, was born in 1610, and died in 1690. He was taught painting by his father, whom he excelled in correctness and finish. He became highly popular, was appointed court painter to the Archduke Leopold William, Governor of the Netherlands, and gave lessons in painting to Don John of Austria. He specially excelled in outdoor scenes, though many of his interiors are masterpieces of colour and composition.

His general subjects were fairs, markets, merry-makings, guard-rooms, taverns, etc., and his pictures, which number over 700, are found in all the important public and private galleries of Europe. *The Village Fête* (Fête aux Chaudrons) is in the National Gallery, London, and *Peasants dancing before an Inn* is in the Louvre. His etchings are also highly esteemed.

TENISON, Thomas. English prelate, born at Cottenham, Cambridgeshire, 29th Sept., 1636; he was educated at Norwich and Corpus Christi College, Cambridge. In 1680 he was presented to the living of St. Martin-in-the-Fields, where he endowed a school for boys. In 1691 he was appointed Bishop of Lincoln and in 1694 Archbishop of Canterbury. He crowned Queen Anne and George I., and died 14th Dec., 1715.

TENNANT, Sir Charles. British merchant, born in Glasgow, 4th Nov., 1823; he was educated there, and entered his grandfather's chemical works at St. Rollox. By his skilful management of this and other industrial ventures he amassed a big fortune. He became a great patron of the arts, and was made a trustee of the National Gallery in 1894. His private collection was opened to the public in the **Tennant Gallery.** He sat in the House of Commons as a Liberal from 1879-86, but later joined Chamberlain as a tariff reformer. He was made baronet in 1885, and died 4th June, 1906. His eldest son holds the title

of Lord Glenconner, and his daughter Margot married H. H. Asquith (q.v.).

TENNESSEE. A south-central state of the United States. It is physically diverse, the surface varying from the traversing ranges of the Appalachians in the east, through the Cumberland Plateau and the plains of the Rim lands, to the Western Valley and the Plateau of West Tennessee, which abuts on the low, flat, alluvial plains (bottomlands, 900 sq. miles in area) of the Mississippi River (the western boundary of the state).

The chief rivers are the Mississippi, the Cumberland, and the Tennessee, all navigable throughout their length; the last two drain over three-quarters of the state. Climatically, Tennessee is exceptionally favoured; along a line through the centre of the state the mean annual temperatures are: east, 57° F., middle Tennessee, 58° F., and west, 59° F. Nashville is state capital; other cities are Memphis, Knoxville, and Chattanooga, all ports of entry.

Railways (*see* NASHVILLE) include the Southern and the Cincinnati Southern. In 1932 there were 3940 miles of steam railway, and 507 miles of electric railway. Tobacco is one of the chief crops; cotton is important; cereals include maize (the chief) and wheat; fruit (strawberries largely) and fruit trees are grown; and stock-raising is fairly wide, though declining, but the annual wool-clip is notable. Forestry is important.

Among minerals, the state produces coal from coal-fields of 4400 sq. miles in area. The production in 1931 amounted to 4,170,000 short tons. Gold, copper, zinc, and marble are also worked. Manufactures are exceedingly varied, and include the working of iron and steel; but generally they are subordinate to agricultural requirements.

The people are predominantly white, and 40 per cent are of the Baptist faith, another 33 per cent being Methodist. Foreign-born people are represented mainly by Germans, English, and Irish (in order of importance).

Elementary education is compulsory up to fourteen years, and the colour-line is rigid. There are twenty-six universities and colleges, including the State University at Knoxville, founded in 1794. The state area is 42,022 sq. miles (335 being water); pop. (1930), 2,616,556.

Tennessee joined the Union on 1st June, 1796, and has a Governor and bicameral Assembly (Senate of 33 members, and House of Representatives of 99 members, both elected biennially). Two Senators and nine Representatives are sent to Congress. There are ninty-five counties. (See articles on cities mentioned.)

TENNESSEE. A river of the United States, formed by the union of the French Broad and Holston Rivers in Eastern Tennessee, flows through Northern Alabama, then through Western Tennessee and Kentucky, and enters the Ohio, of which it is the largest tributary, about 10 miles below the confluence of the Cumberland. Length, about 652 miles; catchment basin, 44,000 miles. It is navigable throughout its entire course during most of the year, and the chief tributaries are also navigable.

TENNIEL, Sir John. British artist, born in London in 1820, died in 1914. He was almost entirely self-taught, and his first picture was exhibited while he was little more than a boy. He devoted himself almost entirely to black-and-white work. In 1851 he became connected as an illustrator with *Punch*, and for fifty years contributed illustrations to that paper, especially the weekly political cartoon. He also illustrated various books, including *Æsop's Fables*, *Ingoldsby Legends*, *Alice's Adventures in Wonderland*, etc. He was knighted in 1893.

TENNIS. An ancient ball game, for long the pastime of royalty and the nobility. Its devotees included Henry VIII. and Charles II., who were expert players, and in France there were many courts, Paris alone having a hundred and fourteen in 1657, as against fifteen in London in 1615.

Tennis-courts are specially constructed buildings, and are somewhat complicated. The game itself is fairly difficult to learn, and beyond the power of many to play well. The court is divided into *service* and *hazard* sides separated by a net; balls of between 2¼ and 2⅝ inches in diameter and 2½ to 2¾ oz. in weight are used, and heavy rackets are employed, without restrictions to size or shape.

With two players X and Y, X, standing in the service end, hits off the ball on to the *service-penthouse*, and the ball must drop eventually in the service-court. Should X fail to perform this feat, it constitutes a *fault*, and two of them make one point, scoring 15. (Four points—15, 30, 40, game—are usually played.)

The game develops into a contest of keeping the ball "off the floor," but chaces and other exceedingly complicated rules and devices stimulate a lively interest as play pro-

gresses.—Cf. *Tennis* (in the Badminton Library); but tennis cannot be understood readily from a formal perusal of a textbook; courts must be visited, and games watched carefully.

TENNYSON, Alfred. The representative poet of Victorian England, born in 1809, and died in 1892. He was the fourth son of the rector of Somersby, in Lincolnshire. His two elder brothers, Frederick and Charles, were also poets of some distinction. Educated at Louth Grammar School and by his father, Tennyson joined, at Trinity College, Cambridge (1828), a band of able young men, which included his greatest friend, Arthur Henry Hallam.

In 1827 Tennyson's earliest verses, echoes of Scott, Byron, and Moore, with individual touches of vivid description, appeared in *Poems by Two Brothers*. His first original verses were issued as *Poems, chiefly Lyrical* in 1830, followed by *Poems* in 1833. The poems in these volumes were very unequal, and many of them underwent in successive appearances a process of elaborate revision, while others were rejected.

The result of this severe discipline, of the unwearied effort to secure by vividness of presentation, significant detail, a clear flute-like melody of vowel and consonant, the perfect expression of the mood of which each poem was a rendering, is evident in the two volumes of 1842, *Poems by Alfred Tennyson*.

Like Spenser, Tennyson is most delightfully a poet in poems that strive to be no more than decorative and musical renderings of a dreamy mood. *Recollections of the Arabian Nights*, *The Dying Swan*, *The Lady of Shalott*, *Mariana*, *The Lotus Eaters*, *The Talking Oak*, *Sir Lancelot and Queen Guinevere*, these are poems which only he could have written, and are as secure against changes of fashion as the *Prothalamion* or the *Il Penseroso*.

But the dramatic, the philosophic, and the didactic spirit was moving Tennyson to produce poems of varying merit: dramatic studies, as the now perfected *Œnone*, *Galahad*, and *St. Agnes's Eve*, the *Morte d'Arthur* (first prelude of the *Idylls of the King*), *St. Simeon Stylites*, *Ulysses*, in which Tennyson's finished art is given a deeper emotional quality; metaphysical poems, like *The Two Voices* and *The Vision of Sin*, the latter not more characteristic of Tennyson s fundamental thought and hope than of his curious metrical felicity.

In others, as *Locksley Hall* and the *English Idylls*, Tennyson's art is used to embroider themes inspired by a vein of sentiment more Victorian than perennial.

Tennyson's range of topics is fully represented in the 1842 volumes—studies of moods, English rural life, mediæval romance, classical legend, the mysteries of life and death and immortality. His later poems are a fuller elaboration of these, with an art that tends to grow more precious, and in a spirit which grows more didactic. *The Princess* (1847-51-3) is a *jeu d'esprit* elaborated and brocaded out of all proportion to the theme, but adorned with some of the loveliest of Tennyson's highly sophisticated lyrics, notably the finely wrought unrhymed "Tears, idle tears."

In Memoriam (1850, but the work of many years) expresses in a poem of one hundred and thirty-two sections, each the rendering of a single mood, Tennyson's sorrow for the death of a friend and his broodings over death and the problems of modern science. The thought of the poem makes less appeal to-day than the beauty of the felicitous stanza and of individual sections rendering sombre moods and lovely landscapes.

The *Ode on the Death of the Duke of Wellington* (1852) and *Maud and Other Poems* (1855) are other striking examples of Tennyson's command of metrical effects and his power of adapting his varying cadences to changes of mood. But the great work of Tennyson's middle years was the *Idylls of the King*, published in batches from 1857 onwards till 1885.

In a style of chiselled, polished, jewelled exquisiteness the poet told a series of stories from Malory's *Morte d'Arthur* and Lady Guest's *Mabinogion* (translations from the Welsh) of Arthur and his Knights and the quest of the Holy Grail, in which he strove, not altogether successfully, to modify the chivalrous Catholic spirit of the originals by the infusion of a modern, vaguely religious, philanthropic, and somewhat maidenly sentiment. Their enormous popularity in their own day has yielded to a depreciation which fails to do justice to their wonderfully varied and finished art.

Enoch Arden (1864), a simple story that Crabbe might have told in his bare manner and creaky verse is decorated with all the resources of Tennyson's blank verse and coloured description. His dialect poems *Northern Farmer*, *Old Style* and the same *New Style* are happie renderings of rural themes.

In his last years Tennyson, under the influence of a poignant sense of disillusionment and of discontent with the age of science and "progress" whose advent he had hailed, shook off this tendency to over decoration and wrote some poems of a direct and piercing power, which, with his early coloured and musical renderings of dream and mood, are likely to outlive his more ambitious pieces.

The dramas *Queen Mary* (1875), *Harold* (1877), *Becket* (1884), etc., hardly count; but *Lucretius* (1868), *The Revenge: a Ballad of the Fleet* (1878), *Ballads and Other Poems* (1880), *Tiresias and Other Poems* (1885), *Locksley Hall Sixty Years After* (1886), *Demeter and Other Poems* (1889), *The Death of Œnone* (1892) included poems that show a weakening grasp and something of an hysterical vein, but also some which are the finest expression of Tennyson's fierce patriotism, his passionate sympathy with certain characters and moods, and his brooding preoccupation with the destiny of man wandering between faiths which are rooted in fear, and science that threatens to dispel hope as well as fear. His closing strains, *Crossing the Bar* and

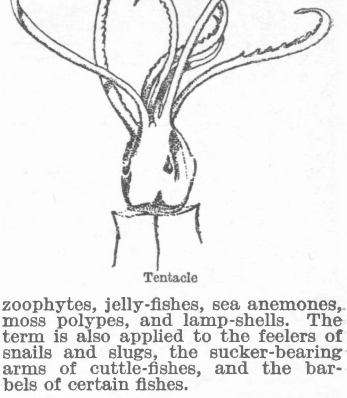
"Will my tiny spark of being wholly vanish in your deeps and heights,"

mark the Stoic-Christian spirit in which he faced the final trial.

Tennyson was raised to the peerage in 1884, and died, pre-eminent among the poets of Victorian England, in 1892. The reaction against Tennyson's finished musical art is not unlike that which Donne and Jonson led against the mellifluous diffuseness of Spenser; and, despite obvious differences, Spenser and Tennyson occupy somewhat of the same rank among English poets, not the very highest, because of a certain lack of intensity and insight, yet surpassed by few in their mastery of all the picturesque and musical capacities of our language.—BIBLIOGRAPHY: Hallam, Lord Tennyson, *Alfred Lord Tennyson: a Memoir*; S. A. Brooke, *Tennyson: his Art and Relation to Modern Life*; W. M. Dixon, *A Primer of Tennyson*; A. Waugh, *Alfred, Lord Tennyson: a Study of his Life and Work*; W. Bagehot, *Literary Studies*.

TENOR. In music, the more delicate of the two adult male voices; its compass generally extends from C in the bass to G or A in the treble. The qualities of the tenor render it suitable to the expression of tender and delicate sentiments. In a vocal composition of four parts the tenor forms the second middle part, deeper than alto, but higher than bass; but in the song of four male voices the tenor, as the first voice, leads the chief melody, and as the second is the higher middle voice. The clef of this voice is the C clef, placed upon the fourth line of the staff, as here shown.

TENTACLE. In zoology, an elongated appendage belonging to the head or mouth end of many of the lower animals; used as an organ of touch and sometimes of prehension. Examples are afforded by hydroid



Tentacle

zoophytes, jelly-fishes, sea anemones, moss polypes, and lamp-shells. The term is also applied to the feelers of snails and slugs, the sucker-bearing arms of cuttle-fishes, and the barbels of certain fishes.

TEN'TERDEN. A municipal borough and market town in the county of Kent, England, 52½ miles from London, on the Southern Railway. At one time it was a Cinque Port, but the sea has receded. It is an agricultural town, and has associations with Ellen Terry. Pop. (1931), 3473.

Charles Abbott, appointed Lord Chief Justice in 1818, was made a peer as **Baron Tenterden** in 1827. He died 4th Nov., 1832.

TENUIROS'TRES (slender-beaked). One of the four artificial sections into which Cuvier divided perching birds; now only used in popular works. This group, represented by the humming-birds, creepers, sun-birds, hoopoes, etc., is characterised by the generally elongated bill, which usually tapers to a point.

TENURE. The general name for the conditions on which land is

held and enjoyed. There are two main systems of land tenure—allodial and feudal. Land held by the former tenure is free of the rights of any superior. It is land held in absolute ownership. It was common in England prior to the Norman Conquest, but was then almost wholly superseded by feudal tenure. Crown lands are, of course, still allodial.

In feudal tenure the person who has the beneficial use and enjoyment of the land (the tenant or vassal) renders some specified service (or in modern times pays a rent or duty) therefor to the superior or lord from whom he received the grant or of whom he holds it. The theory introduced at the Conquest was that all land belonged to the sovereign. Grants were made by the king to his great lords on condition of performing certain services, while they in turn made sub-grants to their own retainers on similar conditions.

In relation to the king they were tenants-in-capite or tenants-in-chief, while in relation to these retainers they were mesne (middle) lords. The retainers, who had the profitable use (or "avail") of the land, were known as "tenants paravail." The highest tenure was knight-service or tenure in chivalry. The lord did homage and swore fealty for his lands. Mounted and armed as a knight and attended by his men-at-arms, he was bound to render military service to the king for forty days in each year if required, and he was also liable for various incidental dues.

Another honourable tenure was grand serjeanty; by virtue of which the service to be rendered was not general military service, as in tenure in chivalry, but a special act, e.g. to carry the king's banner or his sword.

There were also other forms, but in 1660 most feudal tenures were converted into free and common socage. Frankalmoign, copyhold, and grand serjeanty remained. Two ecclesiastical tenures survived the Conquest — "frankalmoign" (free alms), under which religious houses held lands in return for prayers, and "tenure by divine service," e.g. the singing of masses, the distribution of alms, etc. *See* COPYHOLD; SOCAGE; LAND LAWS; etc.

TEOCALLIS ("houses of God"). The name given to the ancient temples of Mexico, of which there are extensive remains. They were generally solid four-sided truncated pyramids, built terracewise, with the temple proper on the platform at the summit. They were constructed of earth, faced with brick, and many still remain in a more or less perfect state. The principal existing specimens are those of Cholula, near Mexico, and of Palenque, in Yucatan.

TEPIC. A town of Mexico, capital of the territory of Nayarit, connected by rail with the port of San Blas. Its manufactures include woollens, cottons, cigarettes, and sugar. Pop. 15,520.

TEPLITZ, TÖPLITZ, or **TEPLICE-SANOV,** now generally known as **TEPLICE.** A town of Northern Bohemia, Czechoslovakia. It has celebrated thermal baths. The springs have a temperature varying from 99·5° to 108·5°, and are efficacious in cases of gout and rheumatism. Pop. (1930), 30,911.

TER'AMO. The northernmost province of Abruzzi e Molise, Midde, Italy. Area, 750 sq. miles; pop. (1931), 226,414.

TERAMO. A city of Southern Italy, capital of the province of Teramo. It is the see of a bishop, and has remains of Roman baths and theatre. Pop. (commune, 1931), 30,667.

TER'APHIM. Household deities or images, reverenced by the ancient Hebrews. They seem to have been either wholly or in part of human form and of small size, were regarded as *penates* or household gods, and in some shape or other used as domestic oracles. They are mentioned several times in the Old Testament.

TERBIUM. One of the rare earth metals; atomic weight, 159·2; atomic number, 65. *See* ERBIUM.

TERBORCH (earlier **Terburg**), **Gerard.** Dutch painter, born about 1618, died in 1681. He studied under his father and at Haarlem, and afterwards visited Germany, Italy, Spain, England, and France. His painting of the peace congress at Münster (1646) is in the National Gallery, London.

TERCE. A legal life-rent amounting to one-third of her deceased husband's heritable property (including heritable securities) in which he died infeft, recognised by the law of Scotland in favour of a widow who has not accepted of any special provision.

TERCEIRA (ter-sā'i-rà). A Portuguese island of the Atlantic, one of the Azores; area, 223 sq. miles. Grains, cattle, some fruit, and inferior wine are produced. Angra or Angra do

Heroismo (q.v.), is the capital. Pop. 49,000.

TER'EBINTH. The common name for various resinous exudations, both of a fluid and solid nature, such as turpentine, frankincense and Burgundy pitch, Canada balsam, etc. The volatile oil of various of these resins is called oil of terebinth, or oil of turpentine. Terebinth is also a name for the turpentine tree (q.v).

TEREBRATULA (ter-ē-brat'ū-la). A genus of deep-sea lamp-shells (Brachiopoda) found moored to rocks, shells, etc. The lower valve is perforated to permit the passage of a fleshy peduncle, by means of which the animal attaches itself. There are few living species, but the fossil ones are numerous, and are found most abundantly in the secondary and tertiary formations.

TEREK. A river of Ciscaucasia, rising in Mount Kazbek and flowing past Vladikavkaz to the Caspian Sea, which it enters by a delta 60 miles wide. The Zunzha is the chief affluent; length, 382 miles (112 miles navigable).

TEREK. A former Russian province of Ciscaucasia, now in the North Caucasian Area (*see* RUSSIA). Vladikavkaz was the capital; Mozdok (pop. 15,000), Georgievsk (11,900), Kislyar (10,000), and Kislovodsk (5000) were other towns. Area, 23,531 sq. miles.

TER'ENCE (Publius Terentius Afer). Roman comic dramatist, born about 195 B.C., and died about 159 B.C. He is said to have been born at Cartage, and to have been brought to Rome as a slave. He was soon set free by his master, Terentius Lucanus, whose name he took. His literary talents gained for him admission to the circle of Scipio Africanus the younger, where he met Lælius, Furius Philus, and Polybius (q.v.), the historian.

Terence's six comedies were written with great care. He appears to have shown his work while in process of composition to Scipio and his friends, and to have revised it meticulously in accordance with their suggestions. According to literary gossip of a later date, Scipio wrote the plays in their entirety; but this ancient counterpart of the Baconian theory is quite untenable.

The six plays of Terence in order of their production are: *The Maid of Andros* (166 B.C.), *The Mother-in-law* (165), *The Self-Tormentor* (163), *The Eunuch* (161), *Phormio* (161), and *The Brothers* (161). All these plays are adaptations from the Greek, *The Mother-in-law* and *Phormio* being based on plays of Apollodorus of Carystus, and the other four being founded on Menander. In most of the plays Terence has combined two or more Greek plays to form one Latin one—a process known by the name of *contaminatio*.

After producing these plays, Terence went to Greece in order to study Greek comedy at closer quarters. He was said to have translated over a hundred of Menander's comedies, but probably he merely made excerpts for future use. He never returned to Italy. According to some accounts, he was drowned at sea; according to others, he died of a broken heart after losing all his translations in a storm at sea.

The comedies of Terence have several good qualities and many defects. Their language is extremely pure, and they are written with an ease which is only paralleled in English by that of the plays of Congreve. They are in every way polished works of art, and are notable among Latin writings as possessing an Hellenic perfection. They have supplied posterity with several apt quotations, such as

> Amantium irae amoris integratio est.
> Hinc illae lacrumae.
> Homo sum: humani nil a me alienum puto.
> Quot homines, tot sententiae.
> Dictum sapienti sat est.
> Nullum est iam dictum quod non sit dictum prius.

Terence has, however, purchased his polished repression at the expense of energy—that *vis comica* of which Julius Cæsar lamented the absence.

There is a lack of variety in his work. His plays are too close an imitation of the Greek. It is inevitable to compare Terence with Plautus, and almost inevitable to prefer the latter. Plautus, though he based his plays on Greek models, was often highly original, and introduced distinctively Roman touches. Terence was an adapter and a polished stylist pure and simple. Plautus was a popular dramatist.

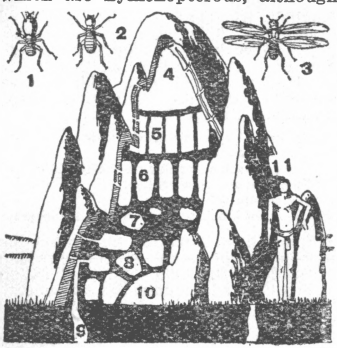
Terence wrote for the aristocracy, and adopted towards the groundlings something of that truculent attitude which is so unpleasant a feature in Ben Jonson. We cannot join Terence in blaming the multitude for going astray after boxers, tight-rope walkers, and gladiators. The comedies of Terence, however, with their perfect workmanship and their cosmopolitan outlook, exercised a salutary influence not only on Latin literature, but on European comedy after the Renaissance.—BIBLIOGRAPHY: J. W. Duff, *A Literary History of Rome*; W. L.

Collins, *Plautus and Terence* (Ancient Classics for Modern Readers Series); J. Sargeaunt, *Terence* (Loeb Classical Library); S. G. Ashmore, *The Comedies of Terence* (text and notes).

TERLIZZI (ter-lit'sē). A town of Apulia, South Italy, in the province of Bari. Pop. 24,000.

TER'MINI IMERESE (ancient **Thermæ Himerenses**). A seaport-town of Sicily, in the province of Palermo, near the mouth of the River Termini on the Tyrrhenian Sea. Corn, oil, olives, and other products of the district are exported, and there is an active fishing industry. It is a spa with thermal saline baths of 106° F. Pop. 21,200.

TERMITES (ter'mīts). A family of neuropterous insects, also known by the name of *white ants*. They have little affinity with the true ants, which are hymenopterous, although



Termites, with Dwelling

1, Soldier. 2, Worker. 3, Winged Adult. 4, Ventilating Chamber. 5, Nursery. 6, Ventilating Chamber. 7, Food Storehouses. 8, Servants' Quarters. 9, Drains. 10, Royal Chamber. 11, Man to compare size.

they resemble them in their mode of life. They are chiefly confined to the tropics, and are found very plentifully in Western Africa. They unite in societies, building their dwellings in the form of pyramids or cones, 10 or 12 feet high.

These dwellings, which are so firmly cemented as to be capable of bearing the weight of three or four men, are divided off into several apartments as magazines, chambers, galleries, etc. Every colony of termites consists of a king and queen, both of which are much larger than the other members of the colony, and of workers and soldiers without wings.

The king and queen are the parents of the colony, and are constantly kept together, attended by a detachment of workers, in a large chamber in the heart of the hive, surrounded by stronger walls than the other cells. The queen is always gravid, the abdomen being enormously distended with eggs, which, as they are dropped, relays of workers receive and convey in their mouths to the minor cells throughout the hive.

At the beginning of the rainy season a number of winged insects, both male and female, are produced. These, when mature, leave the hive and fly abroad, afterwards shedding their wings, and becoming the kings and queens of future colonies. The soldiers and workers, both neuter, or of no fully developed sex, and differing merely in the armature of the head, are distinct animals from the moment they leave the egg, the young differing from the adult of the same class only in size.

The duties of the workers are to build the habitations, make covered roads, nurse the young, attend on the king and queen, and secure the exit of the mature winged insects, while to the soldiers, whose mandibles are powerfully developed for that purpose, is committed the defence of the community, which duty they perform systematically and with desperate courage. There are many species of termites, all of which are extremely destructive to wood.

TERMS. Periods or times connected with law courts, universities, etc. In England the law terms, or periods when the superior courts sat, up to 1873 were four, viz. Hilary term, beginning on 11th and ending on 31st January; Easter term, beginning 15th April and ending 8th May; Trinity term, beginning 22nd May and ending 12th June; Michaelmas term, beginning 2nd and ending 25th November.

The rest of the year was termed *vacation*. The law terms are now superseded by "sittings," though they partly survive in connection with dinners at the Inns of Court. For terms in universities, *see* CAMBRIDGE, OXFORD, etc.; for money terms, *see* QUARTER-DAYS.

TERN (*Sterna hirundo*), or **SEA-SWALLOW.** A genus of birds, included in the gull family. The terns are distinguished by the long, slender, and straight bill, long and pointed wings, and forked tail. The legs are relatively shorter than in the gulls. The common tern or sea-swallow (*S. fluviatilis*) is a familiar visitant of British coasts.

It is a very active bird, seeming

to have a ceaseless flight, and feeding upon small fishes. Its average length is 15 inches. The colour is black on the head and neck, and ashy grey on the upper parts generally. The under parts are white, the legs, feet, and bill being red. This species is native to Europe, temperate Asia, temperate North America, and, as a migrant, in Southern Asia, Southern Africa, and Brazil.

Terns

TERNATE. One of the Molucca Islands (q.v.); area, 12,796 sq. miles. It contains a remarkable volcano (5600 feet), and produces tobacco, cotton, sago, sulphur, saltpetre, etc. The town Ternate (pop. 19,000) is the seat of a native sultan and of the Dutch Resident. Pop. 250,466.

TERNI (ancient **Interamna Nahars**). A city of Perugia, Middle Italy, on the Nera (ancient *Nar*). It has a cathedral (1653, architect Bernini), several other churches, and some Roman antiquities (remains of an amphitheatre, etc.). Near by are the Velino Falls (650 feet in three leaps), formed by the Romans to drain the *Lacus Velinus* (below Reate). They are now used to generate power for factories at Terni, where armour-plate, guns, rails, and machinery are made. Pop. (commune, 1931), 62,741.

TERNSTRŒMIA'CEÆ. A natural order of polypetalous dicotyledonous plants, consisting of trees or shrubs, with alternate simple usually coriaceous leaves without stipules. The flowers are generally white, arranged in axillary or terminal peduncles, articulated at the base. This order is one of great economical importance, as it includes the genus Thea, from which the teas of commerce are obtained. The favourite garden camellia also belongs to it. The plants belonging to the order are principally inhabitants of Asia and America.

TERPSICHORE (tèrp-sik'o-rē). *See* MUSES.

TERRACINA (ter-rà-chē'nà; the ancient **Anxur**). A seaport of Rome (Latium), Middle Italy, on the Tyrrhenian Sea. It is an episcopal see, and has a trade in grain, fruit, etc. Pop. 7580.

TERRA-COTTA, or clay baked without glazing, has from an early date been used for a great variety of purposes, notably for tiles and architectural ornament, and for sculpture in relief and in the round. A suitable earth is first prepared by grinding and mixing with water, and the desired article is then modelled direct or more usually moulded (in which case for finer work retouching is necessary), baked, and sometimes glazed, coloured, or gilded.

For roofing and decorating buildings, both plain and coloured terra-cotta was much used by the Greeks and Romans. At Pompeii, tiles, gutters, and cornices made therefrom may be seen; and in Rome many slabs decorated in low relief have been found which were used for mural ornament.

After the break up of the Empire, terra-cotta fell into disuse in Western Europe, until in the fourteenth and fifteenth centuries it became a frequent adjunct to architecture in Italy and Germany. Fine examples of its use at this period are the church of St. Catherine, Brandenburg, and the Certosa, near Pavia. Later, its use spread to parts of France, to Spain, and to the south and east of England; but in the seventeenth and eighteenth centuries it fell into disrepute, until a widespread revival in the middle of the nineteenth century, which in England produced such buildings as the Albert Hall and the Royal College of Science. A modern instance of the use of glazed terra-cotta is the tube stations of London.

As material for the sculptor, terra-cotta was used in Egypt and Crete; and in Greece took the charming form of the small statuettes,

of which the best examples have been found at Tanagra, in Bœotia. These figures date from 350 to 200 B.C., and chiefly represent, in singularly graceful and attractive fashion, Greek women in the ordinary costume of the day. In Italy the Etruscans used terra-cotta freely for the decoration of sarcophagi, and terra-cotta statuettes were very popular with the Romans, and have been found in every Roman colony.

After a period of unpopularity, in the fifteenth and sixteenth centuries it became the medium in which Donatello, Verrochio, Luca della Robbia, and their lesser contemporaries produced some of their greatest masterpieces; and in the seventeenth and eighteenth centuries it was much used, especially for sketches, or as the basis for subsequent work in bronze or marble. Its advantage over the latter material is the freerer, swifter handling it permits. To-day it is again somewhat out of favour, sculptors preferring, as a rule, to take casts in plaster of Paris from a clay model.

TERRA DI SIENNA. A brown ferruginous ochre employed in painting, and obtained from Italy. When calcined before being used as a pigment, it is known as burnt sienna.

TERRANO'VA, or GELA. A town of Sicily, in the province of Caltanissetta, on the Mediterranean, near the mouth of the River Terranova. It was founded by Frederick II on the site of the ancient *Gela*. There is some export trade in corn, wine, fruit, sulphur, and soda. Pop. 23,270.

TER'RAPIN. The popular name of several species of freshwater or tide-water tortoises of the family Testudinidæ, distinguished by a horny beak, a shield covered with epidermic plates, and feet partly webbed. They are active in their habits, swimming well and moving with greater agility on land than the land-tortoises. They are natives of tropical and warmer temperate countries, many being natives of North America. They feed on vegetables, fish, reptiles, and other aquatic animals. Their flesh is much esteemed.

The name is more particularly applied to *Malacoclemmys terrapin*, native to the salt marshes extending from Rhode Island to the Gulf of Mexico, and especially abundant round Charlestown. Special terrapin farms or "crawls" have been established to rear them for the market.

TERRE-HAUTE (tār-ōt; usually pronounced ter-e-hōt'). A city of Indiana, United States, the county seat of Vigo county, on the Wabash, and Wabash and Erie Canal. There is a polytechnic engineering institute. It is a coal-mining centre, and the nodal point of a busy agricultural region. Pop. (1930), 62,810.

TERRESTRIAL MAGNETISM. The earth behaves as if it were a common magnet on a gigantic scale, that is to say, it is surrounded by so-called magnetic lines of force. These lines of force represent everywhere the direction into which the magnetic axis of any magnetised needle is urged (*see* MAGNETISM). There is no force of translation on the needle, but only a *couple*. In the British Isles to-day such a needle, if free to turn in any direction (for instance, if immersed in a fluid of the same density as itself), would point somewhat steeply down at an angle of about 66° with the horizontal, and, seen from above, its north-seeking end would be found pointing about 14° W. of true or geographical north (*see* DECLINATION; DIPPING-NEEDLE). With the statement of these two angles there remains only one thing to complete the description of the magnetic field at a point, namely the *strength* of the field. We could, if we wished, give instead of the strength and two angles, the component strengths parallel to three rectangular axes of co-ordinates. It is usual to give the horizontal intensity and the two angles mentioned above. Of these the vertical angle is called the *inclination* or *dip*, and the horizontal angle is called the *declination*.

Magnetic instruments are of two classes, for absolute and relative measurements respectively. In order to determine the declination, it is only necessary to suspend a magnet in such a way that it is free to turn in a horizontal plane, and to measure the angle between its magnetic axis and the meridian at the place. To eliminate any error due to the fact that the axis of figure may not be the magnetic axis, it is necessary to arrange the suspension so that the magnet may be turned, bottom for top. The inclination or dip is measured with a *dip-circle*, which consists of a magnet mounted on a horizontal axis resting on knife edges. A vertical circle gives the required angle, and sixteen readings are necessary in all. In the course of these the needle has to be remagnetised in the opposite sense.

The *horizontal intensity* (H) is measured by causing a magnet to deflect another magnet out of its normal position in the earth's magnetic field, and afterwards allow-

ing the first magnet to oscillate undisturbed in a horizontal plane under the influence of the earth's horizontal component of magnetic force. The time of swing is a measure of the product MH, where M is the magnetic moment of the magnet. The deflection experiment measures the ratio M/H, so that the two results when combined give both M and H.

Instruments are in use for the permanent *recording* of the three *magnetic elements*, as they are called. For H, a magnet is suspended by a bi-filar, and is forced by this means into a position at right angles to the magnetic meridian. Any changes in H then cause the suspension to unwind or wind up a little in proportion with the magnitude of the change. The inclination I is not directly recorded, but V takes its place, V being the vertical component of the earth's field, so that tan $I = V/H$. A magnet is so balanced on knife edges that the vertical magnetic force tending to make it tilt is balanced by the action of gravity. Small changes in V then produce proportional tilts in the magnet. The positions in all cases are recorded photographically by a spot of light reflected from a small mirror on the magnet. It has been proposed to supersede the deflection and oscillation experiments by an electrical method involving the field of a coil of wire carrying a current.

If the *magnetic poles* of the earth, i.e. the places where the dip is 90°, lay in the earth's axis, the lines of force would everywhere run in the geographical meridian, i.e. the declination would everywhere be zero. All lines connecting places with similar magnetic states, such as *isoclinal lines* for places of equal inclination, would be parallels of latitude. Actually there are considerable variations from this simple distribution, and the magnetic poles, instead of coinciding with the geographical poles, are situated at about 70° N., 97° W., and 73½° S., 147½° E. Thus the north magnetic pole is on the meridian of Winnipeg, half-way from that place to the geographical North Pole, while the south magnetic pole is on the meridian of Hobart Town, and is two-thirds of the way from there to the geographical South Pole. The antipodal point of either magnetic pole is over 1300 miles from the other magnetic pole.

The magnetic elements at all points are subject to *changes* of several kinds. The *secular change* is a slow change in all the elements extending over centuries (*see* DECLINATION). Besides the secular changes there are rapid fluctuations in the magnetic elements, in which regular waves having a diurnal and a semi-diurnal period have been detected. These have been referred to atmospheric electric currents produced either by the tidal action of the moon and sun on layers of the earth's atmosphere which are not electrically neutral, or (more intensely) by the projection of radiations, both corpuscular and ultra-violet, from the sun into the upper atmosphere. Intense corpuscular streams give rise to so-called magnetic storms, which are disturbances world-wide in their incidence, and whose *sudden commencements* are nearly but not quite simultaneous at places widely separated. A connection has been established between the frequency of sunspots and of magnetic storms.

Unfortunately the current rate of annual change in the British Isles cannot be determined from the mean rate over a number of years. Between 1901 and 1915 the annual change of declination increased from about 4 minutes to 10 minutes. It is usual as a first approximation to take, for the present day, 9 minutes as the annual diminution of declination in the British Isles. The *dip* attained a maximum of nearly 75° about the year 1700, and was in Jan., 1915, 66° 52′ at Greenwich.—

BIBLIOGRAPHY: Stewart and Gee, *Elementary Practical Physics*; W. Watson, *Textbook of Physics*; C. Chree, *Studies in Terrestrial Magnetism*; *Terrestrial Magnetism and Atmospheric Electricity* (*International Quarterly*).

TERRESTRIAL PHYSICS, or GEOPHYSICS. A subject closely related to *geology*, and including *geodesy*, *terrestrial gravity*, *meteorology*, *oceanography*, *terrestrial magnetism*, and *seismology*. (For these subjects, see separate articles.) In a narrower sense of the word, geophysics refers mostly to the properties of the solid earth and its behaviour under various forces.

Many speculations have been made as to what the interior of the earth is really like. It is generally accepted that the whole of it was once in a molten and intensely hot state, and that its present state is that of a much-cooled and probably still cooling body. This introduces the problem of the age of the earth. If it be idle to speculate on the length of time over which the earth has existed as a separate body, the duration of the geological or crust-forming period is not beyond a guess. From considerations of heat content and heat conduction, Lord Kelvin was led to

the estimate of 20 or 30 million years. Recently, however, the admission of radio-activity as a factor in the argument has led physicists, in particular Lord Rayleigh, to an estimate of a few thousands of millions of years, say 4×10^9 years. It must be remembered that in an estimate of this kind the uncertainty is not expressed as plus or minus so much, but as a multiplier or divisor by so much. In the opinion of the late Professor Joseph Barrell, the estimate of 4×10^9 years was not wrong by more than factors $\frac{1}{3}$ or 3 times. This estimate has not passed unchallenged, though it is universally agreed that Lord Kelvin's original figure may well be many times too small.

Returning to the question of the earth's interior, one of the most natural suppositions is that there is a hot fluid interior surrounded by a comparatively thin crust. We have before our eyes the phenomena of volcanoes with their outpourings of lava. Yet the fluid theory is now abandoned by geologists and physicists alike. The extrusions of volcanoes are not on a scale comparable with the action of stresses known to exist in the earth's crust. More conclusive still, the propagation of earthquake waves, both compressional and distortional, to great distances shows that not only is the earth a solid to a depth of more than half its radius, but it is a rigid solid rather than a viscous mass.

Next comes the problem: If the bulk of the earth be rigid, how can the movements observed in the crust take place? Plainly, there have been in the past, and there are in progress now, great earth movements, displacing portions of the crust both vertically and horizontally. Part of Scandinavia has been proved to be undergoing actual elevation at the present day at the rate of about 1 centimetre per annum; while in the foreground of the Bavarian Alps relevelling and retriangulation after lapses of thirty or forty years have established vertical movements of 0·1 metre, and horizontal movements approaching 1 metre. These movements are consistent with a continued pushing northwards of the Alpine mountain mass. On the small scale we may observe in exposed cliffs bent and folded strata.

How is it possible to reconcile these movements with the rigidity which we know the earth to possess? The answer is that the stresses to which the creeping or viscous movements are the response must be very long sustained. That these stresses are continually present we know from earthquake phenomena. But the bulk of the movements in the earth's crust which have made its past history have been of the slow creeping kind. Only now and then does the strain become unstable in a certain region, and produce the sudden release which we know as an earthquake.

The most recent views on *isostasy* (q.v.) contain the idea of a somewhat more yielding stratum beneath the outer crust. This stratum is rigid for such short-period stresses as those due to the passage of an earthquake wave, but yields enough to allow of the upheaval of the crust at the points where the latter is naturally light, or has been lightened by denudation.

Since the earth is rigid for ordinary stresses, it is necessary to inquire whether a numerical estimate of this rigidity or elasticity can be made. On this problem the rotation of the earth and its changes of position relative to the sun and moon throw interesting light. Although the spheroidal figure of the earth is practically that of a fluid rotating under similar conditions, the phenomenon known as Chandler's Nutation shows that the earth is now, as a whole, as rigid as steel. This nutation, or nodding, consists in a very minute displacement of the earth's axis of rotation amounting to a wandering around a radius of about 15 feet at the pole. The period of the free nutation, which was predicted by Euler to be 10 months, was shown by Newcomb to be modified to 14 months by a supposed finite earth rigidity equal to that of steel. Again, it has been shown that in a viscous earth the free nutation would soon be damped out. What Chandler demonstrated by an elaborate analysis of observations was a periodic variation of latitude with a period of about 430 days, and showing no signs of being damped out. Therefore the earth is as rigid as steel, and for stresses of as long duration as 6 or 7 months shows still no viscous yielding as a whole. This is borne out by experiments on tides in water-pipes by Michelson and Gale in the United States.

Besides the world-wide force exerted on the earth by reason of its own rotation—the centrifugal force—and its change of position relative to the sun and moon—the tidal forces—there are some minor reactions of the two envelopes with which the earth is invested.

First, the ebb and flow of great masses of water on the shores of the land produces a minute tilt in the solid crust. This is a difficult measurement to make, but it has been suc-

cessfully accomplished. The difficulty lies not only in the extreme delicacy of the measurement, but in disentangling from it small effects due to other causes than the one considered, viz. the tilting due to response of the earth itself to the tide-generating force, the differential tilt, if any, of the pendulum in response to the same force, and the effect of the direct attraction of the tidal water on the pendulum.

Second, the atmosphere, although very small in density, exerts a pressure whose changes from time to time, and from place to place, are sufficient to react both on the sea and on the solid earth. It is well known that an increase of barometric pressure is able to depress the sea locally, and force it up in places where the barometer is lower. The sea at any given place is therefore a kind of barometer on a very large scale, but the effect is different for each locality, and may be masked by other more complicated factors. It is understood, of course, that these atmospheric effects are additional to the ordinary oscillations which are known as the tides.

Again, since the solid earth possesses a finite rigidity, the varying atmospheric pressure must produce distortions in it. The late Sir George Darwin calculated that on occasion the tilt in the earth's crust produced by barometric gradient might be greater than the deflection of the vertical by the direct tidal force of the moon. That the atmosphere does exert an appreciable effect on the rocks of the earth is strikingly illustrated by the fact that barometric gradient has been recently shown to be at least a secondary cause in the precipitation of earthquakes in seismic regions.

Enough has been said to make it clear that the solid earth, far from being the inert mass which it presents to a first gaze, is the seat of a continual evolution. Though it is true that the changes take place at a rate which seems infinitesimal to any given generation of mankind, it is largely upon this physical evolution of the earth's crust that the destiny of the human race has depended in the past, and may depend in the future.—BIBLIOGRAPHY: O. Fisher, *Physics of the Earth's Crust*; J. W. Gregory, *The Making of the Earth*.

TERRIERS. This class of dogs is noted for its gameness and intelligence. From the smallest (Yorkshire) to the largest (Airedale) they all make excellent watch-dogs. The Airedale, on account of his strength and courage, is largely used by police to accompany them in patrol work. The fox terrier and Border terrier are used in "bolting" the fox, i.e. they are put into a drain or den, and by their courage

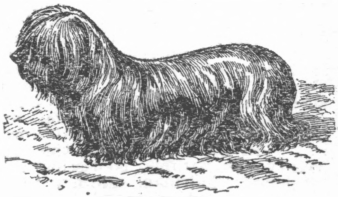
Bedlington Terrier

force the fox into the open. They are all good "ratters."

Airedale: rough coated; marks—black saddle and tan. *Kerry Blue*:

Welsh Terrier

long hard blue coat; resembles the Airedale in size and weight. *Irish*: rough hard coat, red in colour. *Fox*: two types, smooth and rough; colour white with black, or black-



Skye Terrier

and-tan marks. *Scotch*: coat wiry and hard; colour black or brindle; stands on short straight legs, and long body. *West Highland*: coat wiry and hard; colour white with no marks; in temper resembles Scotch. *Cairn*: small-

sized terrier; dark or light brindle in colour; very game. *Sealyham*: resembles wire-haired fox terrier, but on shorter legs, and longer in the body. *Bedlington*: medium-sized, built on racing lines; coat silky, close, and wavy; colour blue, and ears placed on side of head. *Welsh*: miniature Airedale; colour and markings the same. *Dandie Dinmont*: coat fairly long and wavy; colour either pepper (bluish) or mustard (red). *Skye*: coat long and silky, and blue coloured; stands on short legs; has a longish body. *Yorkshire*:

Black-and-Tan Terrier

coat long and silky; colour blue with tan markings; ladies' toy terrier, and smallest. *Bull Terrier*: coat short, close, and fine; colour white; originally a cross between bulldog and fox terrier. *Border*: coat smooth and thick; colour sandy; second smallest terrier; very game. *English* (*Black-and-Tan*): name gives his colour; coat short and fine.

TERRITORIALS (the Territorial Army). The second-line army of the kingdom. Under the name of the Territorial Force it was first formed in 1907 out of the existing yeomanry and volunteers (Territorial and Reserve Forces Act, 1907, 7 Edw. VII., c. 9). The heading of this Act was: "An Act to provide for the reorganisation of His Majesty's Military Forces, and for that purpose to authorise the establishment of County Associations and the raising and maintenance of a Territorial Force. . . ." In accordance with this Act, county associations, consisting of a president, chairman, military representative, and co-opted members, were formed in each county (or portion of a county where the area was too extensive to be dealt with as a whole), for the purpose of organising and administering the Territorial units within the area, of recruiting for the force, of providing training facilities and accommodation for arms and equipment.

The Associations also exercised the right of submitting names for first appointments to commissions in the force. Enlistments were for a period not exceeding four years, and the annual training was for not less than eight or more than fifteen days, in addition to certain drills.

The area of service for the force was limited to any part of the United Kingdom, and "no part of the Territorial Force shall be carried or ordered to go out of the United Kingdom." A proviso was, however, made to the effect that "it shall be lawful for His Majesty, if he thinks fit, to accept the offer of any part or men of the Territorial Force, signified through their commanding officer, to subject themselves to the liability (1) of serving outside the United Kingdom; (2) of undertaking actual military service for the *defence of and within* the kingdom whether the Force was embodied or not." It was under this section that the services of the greater proportion of Territorial units became available in the early days of the European War, for, though the whole force could be and was embodied along with the rest of the Reserve forces, yet, legally, only home defence could be demanded of them.

During the war the units of the Territorial Force served with great distinction in more than one theatre of war, and the Earl of Ypres has said that in the first year of the war it would have been impossible to have held the Germans without the assistance of the Territorial divisions. At the outbreak of war the Territorial Force numbered fourteen divisions; by raising new units this number was rapidly doubled. In France, Belgium, and other theatres the exploits of the 47th (London) Division, the 51st (Highland) Division, the 55th (West Lancashire) Division, and the 56th and 58th (London) Divisions, among others, are matters of common knowledge. (For a summary of Territorial exploits during the European War, cf. Rudolf's *Short Histories of the Territorial Regiments of the British Army*.)

In common with the rest of the army the Territorial Force underwent its post-war reorganisation, from which it emerged as the Territorial Army, with an obligation to serve in any part of the world where its services might be required in time of imminent national danger. In order to prevent any possible misuse of this power by the Government of the day, a proviso is contained in the Act to the effect that before

Territorial units are ordered out of the country the case must be laid before Parliament. Since 1st Oct., 1932, the Territorial Army has also been entirely responsible for manning the Coast Defences at home. In March, 1921, 100,000 of all ranks had been enlisted into the Territorial Army, the desired establishment being 236,000; by January 1932, the number had risen to nearly 136,000 of all ranks. On 1st. Jan., 1933, the strength of the Territorial Army was 6901 officers and 120,167 other ranks.

The Territorial Army, like the original force, consists of 14 divisions, composed of infantry, artillery, engineers, and auxiliary services, also mounted brigades, but whereas in the Force there were fifty-five regiments of yeomanry-cavalry (q.v.), in the Territorial Army of to-day there are only ten regiments of cavalry, the remaining forty-five being in process of conversion into armoured-car or artillery units. This is in keeping with the trend of modern ideas, and conforms to some extent with the action taken as regards the regular cavalry. The Honourable Artillery Company ranks as the senior corps in the Territorial Army. This unit has an unbroken existence since the fifteenth century, and became part of the Territorial Force in 1908.

The Territorial Army is represented at the War Office by a Director-General, who is a member of the department of the Under-Secretary of State for War. No unit of the Territorial Army (unless embodied) can be called out in aid of the civil power. Embodiment is done by means of a Proclamation. The Territorial Army cannot be embodied unless and until the whole of the Army Reserve has been called up. There is a Territorial Reserve in process of formation. *See* ARMY; VOLUNTEERS.

TERRITORY (Lat. *territorium*). A designation with many meanings, the chief of which have political significance. In the Holy Roman Empire, the Empire possessed no territorial domains, and the word "territory" indicated the lands of reigning princes, Imperial cities, and free towns, and the sphere within which these sovereigns and states exercised seigniorial or sovereign rights.

In modern times in the United States a territory is a region under Union Government but not yet admitted as a state. Canada has two territories, Yukon Territory and the North-West Territories (q.v.). Australian territories are of three kinds: (1) those forming part of the Commonwealth and not belonging to individual states (Federal Capital Territory and Northern Territory); (2) those accepted under Clause 122 of the Constitution, which provides for further territorial acquisitions (Papua and Norfolk Island); and (3) those accepted under mandate from the League of Nations (New Guinea and Nauru Island). Some South American republics have territories that are not yet states, e.g. Brazil (Territory of Acre), Bolivia (Colonial Territory), and Chile (Magallanes Territory). Argentina has ten territories.

TERROR. An extinct volcano on Ross Island, South Victoria Land, Antarctica; height, 10,750 feet. It was named after the ship of Sir James Ross, who discovered it in 1841.

TERRY, Dame Ellen Alicia. English actress, born in 1848. She made her first appearance on the stage in 1856 at the Princess's Theatre, under the management of Charles Kean. Her real debut was in 1863, at the Haymarket, as Gertrude in *The Little*

Ellen Terry

Treasure. In 1875 she made a sensation as Portia, under the Bancrofts. On 30th Dec., 1878, she made her first appearance with Henry Irving at the Lyceum Theatre. Her rôle on that occasion was Ophelia, always one of her finest parts; and among others sustained by her during her long association with the Lyceum and Sir Henry Irving are Pauline (*The Lady of Lyons*), Portia, Juliet, Beatrice, Viola, Lady Macbeth, title-rôle in Reade's *Nance Oldfield*, Queen Katharine in *Henry VIII.*, Cordelia, Rosamund (Tennyson's *Becket*), and Imogen. After Irving's death in 1905 she continued to act at the Court Theatre under her own

management. Her stage jubilee in 1906 excited world-wide interest. In 1925 she received the Grand Cross of the Order of the British Empire. She died in 1928. Her only book, *The Story of my Life*, appeared in 1908. Sir Johnston Forbes-Robertson said of Ellen Terry that "taken all in all, she was one of the most remarkable figures in the history of the stage." BIBLIOGRAPHY: Charles Hiatt, *Ellen Terry and her Impersonations* (1898); Clement Scott, *Ellen Terry* (1900); E. Gordon Craig (her son), *Ellen Terry and her Secret Self* (1931).

TERSCHELLING. An island of the Netherlands, in the province of North Holland, at the entrance to the Zuider Zee; area, 42 sq. miles (partly inundated). Hoorn is the chief town, and Westerschelling is the fishery centre. Pop. 4120.

TERTULLIAN (Quintus Septimius Florens Tertullianus). The earliest of the great Latin Fathers, born between A.D. 150 and 160 at Carthage; son of a Roman centurion, died between 220 and 240. He was converted, probably in Carthage, about 192, and was made a presbyter. In middle age, about 202, he became a Montanist (*see* MONTANUS). He is known chiefly through his writings, which are very numerous, whether in the Catholic or the Montanist period of his career.

His most celebrated work is the *Apologeticum*, a formal defence of Christianity, addressed to the governor of proconsular Africa, and couched in defiant rather than persuasive terms. He wrote other apologetic works, also works of a doctrinal and practical nature. The *Ad Praxeam* is a landmark in Western theology, and is of special significance for the history of the development of Trinitarian doctrine. He was the founder of ecclesiastical Latin, and his works display great learning, much imagination, and a keen if often coarse and satirical wit. He was the first of the great triumvirate of the African Church, the two others being Cyprian and Augustine.

TERUEL'. An inland province of North-Eastern Spain. It is largely mountainous. Teruel is the capital. Area, 5720 sq. miles; pop. (1931), 252,853.

TERUEL. A city of Spain, capital of the province of Teruel, near the Guadalaviar; served by the Calatayud-Valencia Railway. An ancient city, Teruel is a bishop's see, and has a cathedral. Pop. 13,584.

TERZA RIMA. An Italian form of versification, consisting of three iambic lines of eleven syllables each. Each stanza is linked with the next, lines 1 and 3 repeating the central rhyme of the preceding stanza. The rhyme scheme is therefore as follows: aba, bcb, cdc, etc. The terza rima was perfected by Dante, who used it in his *Divina Commedia*. The verse form was introduced into English by Sir Thomas Wyatt, and experimented with by Sir Philip Sidney and Milton. Mrs. Browning's *Casa Guidi Windows* is written in terza rima.

TESCHEN (Pol. *Cieszyn*; Czech, *Tesin*). A former district of Austrian Silesia, known as Lower or Eastern Silesia. Troppau was the Upper or Western district, and these two, comprising an area of 2026 sq. miles, formed the smallest Crown-lands of the Austrian Empire, the fragments of the Old Silesia surrendered by Maria Theresa to Frederick the Great of Prussia (1742).

After the European War, in 1919, a territorial dispute began between Poles and Czechs regarding the ownership of Teschen, a desirable area producing coking-coal, and at the same time a veritable hive of industry. In the area Poles made up 76 per cent of the population; Germans, 17 per cent; and Czecho-Slovaks, 6 per cent. On 8th July, 1920, the Council of Ambassadors at Paris partitioned the region, the east (predominantly Polish) being attached to Poland, while the Czechs received the mining region and the chief railway.

TESCHEN. A town of Poland, formerly in Austria. It is about 50 miles S.E. of Troppau, and is situated on the Olsa, a tributary of the Oder. Coal is mined, and other industries are tanning, cloth weaving, and flax spinning. The Poles call the town Cieszyn, the Czechs Tesin. Pop. 23,336.

TES'SERÆ. Small cubes or squares resembling dice, and consisting of different materials, as marble, precious stones, ivory, glass, wood, etc. These *tesseræ* were used by the ancients to form the mosaic floors or pavements in houses, for ornamenting walls, etc. *See* MOSAIC.

TESTING OF MATERIALS. In engineering workshop practice, the properties of materials, knowledge of which is essential for both manufacturer and designer, is obtained by conducting a series of tests upon samples.

Tests of Forgings. If forgings are not too large and are of suitable section, tests are taken from the actual forgings in a ratio of 1 in 10 pieces. When the forging is large and too expensive to destroy, per-

mission is usually given to make it of sufficient size to include a test-piece, which must represent an average section of the forging. The test-piece must not be further reduced by hammering, nor reheated, but may be machined to test-piece dimensions.

The usual tests taken from forgings are tensile, bend, and hardness (Brinell) tests. The form of the **tensile** test-piece is preferably circular, but where the section of material does not admit of this it is rectangular. The ends of the test-piece are screwed to fit the screwed socket of the testing-machine, or when rectangular left plain to suit the serrated wedges of the machine. The centre part of the test-piece is turned down to a standard size corresponding to the capacity of the machine, and to ensure fracture within the actual test-piece distance, which may be 2, 6, or 8 inches, care should be taken to have a direct axial pull on the test-piece.

Bend Tests are usually supplementary to and taken from the same test-pieces as the tensile tests. These pieces are of 1¼-inch square section, about 8 inches long, and are bent cold round a diameter 2½ times the thickness of the test-piece until the ends meet, then hammered until the arms are parallel without sign of fracture.

Brinell Hardness Tests consist in pressing a hardened steel ball, of radius 5 mm., into the flat surface of the test-piece under a pressure of 3000 Kgm. and measuring the curved area of the indentation.

$$\text{Brinell hardness number} = \frac{\text{total pressure}}{\text{curved area of indentation}},$$

the pressure being in Kgm., and area in sq. mm.

Rivet Tests. The following are three representative tests as required by the Admiralty: (1) bending double when cold without fracture round a radius equal to half the diameter of the rivet; (2) bending double when hot, and hammered till the two parts of the body are parallel and touching without fracture; (3) flattening of the rivet head while hot until its diameter is 2½ times the diameter of the body without fracture.

Test-pieces from Castings. The test-pieces should be cast with, and joined to, the casting they represent. Both tensile and transverse tests are taken. The tensile test is made on a 2-inch length, 6 inches overall. For the transverse test the sections are: 2 in. × 1 in. × 3 ft. long on 3-ft. centres, and the bar to break with a minimum load of 28 cwt.; also 2 in. × 1 in. × 14 in. and 1 in. × 1 in. × 14 in. long, each on 12-in. centres. The foregoing are typical tests in general specifications; other and more elaborate tests are usually confined to research and laboratory work. *See* STRENGTH OF MATERIALS.

TESTING OF MILK. Various methods are adopted, other than those of the analytical chemist, for ascertaining the purity, fat content, etc., of milk. For specific gravity, rapid tests are made by lactometer (q.v.) or Westphal balance (q.v.). The percentage of fat present in a given sample is found in Great Britain by the Gerber system mainly, what is known as the Babcock system being favoured in the United States and the Imperial colonies.

In testing milk by the Gerber system, 11 c. c. of the sample are pipetted into a special test-tube, 10 c. c. of sulphuric acid (specific gravity, 1·820 to 1·825) being added, and 1 c. c. of amyl alcohol run in finally to prevent charring. The test-tube is corked, shaken up, and revolved in a centrifugal apparatus for about five minutes, when the fat separates out, and may be read off directly as a percentage from the scale on the neck of the test-tube. A method devised by Dr. Gerber, and called the "Sal" system, makes use of a special "sal" solution and butyl alcohol, instead of sulphuric acid and amyl alcohol.

TEST-PAPERS. Slips of unsized paper impregnated with solutions of vegetable colouring-matters or other chemical reagents, used as indicators of the presence of acids or of alkalis or of special chemical compounds. The most common test-papers are litmus, turmeric, and starch papers.

TESTUDO. Among the ancient Romans a cover or screen which a body of troops formed with their oblong shields or targets, by holding them over their heads when standing close to each other. This cover somewhat resembles the back of a tortoise, hence the name (Lat. *testudo*, tortoise), and served to shelter the men from missiles thrown from above. The name was also given to a movable structure on wheels or rollers for protecting sappers. (Illus. on p. 174.)

TET'ANUS. A disease of the central nervous system, caused by the bacillus tetani. The bacillus gains entry to the body through a cut or wound, and from the original site of infection the toxins are carried by the circulation to the nervous system. The incubation period varies considerably, but ten days is the most frequent period. The premonitory symptoms are sleeplessness, restless-

ness, sweating, with muscular twitchings, followed by definite muscular spasm, which is usually first seen in the masseter muscles of the face, so that the patient is unable to open his mouth; hence the popular name, lockjaw. The neck next becomes rigid, and then the muscles of the trunk and limbs. The spasms cause great pain, and it is necessary to control them by morphia, chloral, or chloroform.

During the European War (1914-8) at first many of the wounded were infected with tetanus, until prophylactic inoculation with antitetanic serum was introduced. This was found to be of great value, and when it had been established and every wounded man was inoculated as early as possible, the number of cases of tetanus became very small.

TETE. A district and town in the province of Mozambique, Portuguese East Africa.

Roman Soldiers fighting under a Testudo (from a bas-relief)

Physical Features. The district is sandwiched between Nyasaland and Rhodesia, and through it the Zambezi River passes in a wide sweep from west to east, forming a northern and a southern region. The former rises gradually to the plateau of Central Africa, and is in parts densely wooded, towards the Nyasaland frontier. In

the south the land rises to the plateau of Southern Rhodesia. The whole region is more or less dominated by the tsetse fly, and transport presents a problem, for the only railway is the section of the Central African system, running from Chindio to Port Herald in Nyasaland, a distance of 60·5 miles. The river is navigable for stern-wheel river-steamers as far as Tete town, but it is broken by the Kebrabasa rapids (60 miles) farther up. The Shiré River bounds the northern region in the east, and the Ruenya does the same for the southern. Zumbo may be considered the western river-outpost of the district.

People. The natives number perhaps 200,000, and the Europeans only 200. There are some Asiatic traders.

Resources. The mineral wealth of Tete is undeveloped, but millions of tons of excellent coal await exploitation. A large area is the monopoly of the Campanhia de Zambezia and the Zambezia Mining Development Company. Iron, magnetite, and limestone are found, and there is some alluvial gold-mining near Tete town.

Tete Town is a Zambezi port and the district capital, and is the terminal of a projected line from the Chindio-Port Herald Railway. It stands in a dry, treeless region, is the headquarters of Europeans and Asiatics, and is a collecting-centre for gold-dust and ivory. *See* also the article on PORTUGUESE EAST AFRICA.

TETRABRANCHIA'TA. An order of Cephalopoda or cuttle-fishes, having four branchiæ or gills, comprising the two families Nautilidæ and Ammonitidæ. Of this order the pearly nautilus may be regarded as the type, being the only living member of the order, though its fossil representatives (Orthoceras, Ammonites, etc.) are abundant. *See* NAUTILUS.

TETRAHE'DRITE, or **GREY COPPER ORE.** A mineral sulphide of copper and antimony, occurring in many mines, and containing about 40 per cent of copper. Silver is usually present in it.

TETRAZZINI, Luisa. Italian prima-donna (soprano), born 1874. A Florentine herself, she made her début in the Teatro Verdi there (1895), and eventually appeared at Covent Garden (1907), after enjoying musical triumphs in Rome and New York. *Lucia di Lammermoor* is her favourite opera. In 1921 she published *My Life of Song.*

TETTENHALL. Urban district of Staffordshire. It is 2 miles from Wolverhampton. Near is Wrottesley Hall, the residence of Lord Wrottesley. Pop. 5767.

TETUAN'. The administrative capital of the Spanish Zone of Morocco; connected with its outposts and with Ceuta by railway. Pop. (1926), 38,000.

TETZEL, Johann. German friar, born about 1470, died in 1519. He entered the order of the Dominicans, and in 1502 was appointed by the Roman see a preacher of indulgences, and carried on for fifteen years a very lucrative trade in them. His life was so corrupt that at Innsbruck he was sentenced to be drowned for adultery, but got off through powerful intercession. Having travelled to Rome, he was absolved by Pope Leo X., and now carried on the sale of indulgences with still greater effrontery. Luther came out with his theses against this crying abuse in 1517. Tetzel died of the plague in the Dominican convent at Leipzig. A great part of the money acquired by his traffic in indulgences was used for the erection of St. Peter's church at Rome.

TEU'TONES, or **TEUTONI.** A tribe whose original home seems to have been a district in the north-west of Germany to the north of the Elbe. In 102 B.C., together with the Ambrones, they invaded Gaul and reinforced the Cimbri. They ravaged Gaul, but were defeated in a great battle near Aquæ Sextiæ (or Aix) by Marius. It has been questioned by some writers whether the Teutones were a German rather than a Celtic or Slavonian race, although they are classified by Strabo as Germani.

TEUTONIC LANGUAGES. *See* PHILOLOGY.

TEUTONIC ORDER. A military religious order of knights, established (1198) in imitation of the Templars and Hospitallers. It was composed chiefly of Teutons or Germans who marched to the Holy Land in the Crusades, and originally established (1190) as a Jerusalem charitable institution. In the thirteenth century the order acquired Poland and Prussia, and long held sway over a great extent of territory in this part of Europe. It began to decline after the defeat of the knights at Tannenberg by King Ladislaus II. (or Yagello) of Poland (1410), and was finally abolished by Napoleon in 1809.

TEVIOT. River of Roxburghshire. It rises on the Dumfriesshire border and flows across the country until it falls into the Tweed near Kelso. It passes by Hawick, is noted for its

fishing, and is 40 miles in length. The beautiful district through which the river flows is known as **Teviotdale.**

TEWFIK PASHA, Mahommed. Khedive of Egypt, eldest son of Khedive Ismail, born in 1852, died in 1892. He succeeded to the Viceroyalty (8th Aug., 1879) upon the forced abdication of his father. He was the sixth ruler of Egypt in the dynasty of Mahommed Ali Pasha.

TEWKESBURY (tūks'be-ri) A municipal borough of Gloucestershire, England, where the Avon joins the Severn. An agricultural centre, the town is famous for its abbey church, once part of a Benedictine monastery. Tewkesbury is the Nortonbury of *John Halifax, Gentleman.* Pop. (1931), 4352.

During the Wars of the Roses, the **Battle of Tewkesbury** was fought near here, 3rd May, 1471. It resulted in the defeat of the Lancastrians.

TEXAS. A west-south-central state of the United States, and the largest of that country. Area, 265,896 sq. miles; pop. (1930), 5,824,715 (fifth in population, coming after New York, Pennsylvania, Illinois, and Ohio).

Physiography. Texas has a coastline of about 400 miles on the Gulf of Mexico. It is fringed by storm-beaches and lagoons, which give place to a wide alluvial coastal plain, backed by a central prairie-land, merging in the west with the high plateau and the eastern region of the Llano Estacado (*see* LLANOS). A northerly projection of the state between Oklahoma (east) and New Mexico (west) is called the Panhandle, and is drained in the north by the Canadian River. The Red River forms the northern boundary of the state, east of the Panhandle, and the Rio Grande del Norte forms the southern boundary.[1] Forming part of the eastern boundary with Louisiana is the Sabine River, which rises in Texas; and the Colorado, entirely within the state, drains the central prairie region. Other rivers are the Brazos (east-central) and the Pecos (west).

Climate. Climatically, Texas is healthy; but the Panhandle is cold in winter. The mean annual temperature at Galveston (69 feet altitude) is 69·8° F. (July, 83·6° F.; January, 53·6° F.), and at San Antonio (701 feet altitude) 68·9° F. (August, 88·3° F.; January, 52·7° F.). September at both places is the wettest month.

Towns, etc. Austin (pop. in 1930, 53,120) is the state capital, but Houston (292,352) is the largest city. Galveston* (52,938) is the chief United States cotton port, second only to New York; other cities are: Dallas (260,475), San Antonio (231,542), Fort Worth (163,447), El Paso* (102,421), Beaumont (57,732), Waco (52,848), Port Arthur (50,902), Wichita Falls (43,690), Amarillo (43,132), Eagle Pass,* Brownsville,* and Corpus Christi.*

The asterisk (*) indicates a port of entry.

Communications. In 1931 the state was traversed by 17,203 miles of steam railway (e.g. Santa Fé, Southern Pacific, and Colorado & Southern Railways); there were also 518 miles of electric railway. The rivers provided 1047 miles of navigable waterway. The Houston Ship Canal (50 miles), from Houston to the Gulf of Mexico, makes that city the greatest inland cotton market of the world.

Production and Industry. Texas is a prosperous agricultural state, producing maize, wheat, rice, tobacco, sorghum, and fruit, and is one of the great cotton producers, with an output of 4,445,000 bales in 1932. The live-stock industry is progressive, and supports an extensive allied manufacturing industry in slaughtering and meat-packing; while the wool-clip amounts to about 17,000,000 lb. Minerals worked include petroleum and natural gas, bituminous coal, mercury, and many varieties of stone. The refining of petroleum is the most valuable industry, with meat-packing second; but there are large rice-cleaning and polishing interests, and cottonseed-oil and -cake manufactures.

People. Of a total population of 5,824,715 (1930), 4,283,491 were white, 854,964 negro, 683,681 Mexican, 1001 Indian, 1578 Asiatic. The colour-line is rigid, even in education, and the blacks have their own State university. There are four denominational universities (Roman Catholic, Methodist (2), and Baptist), and one State university at Austin (founded 1883).

Constitution. Texas originally formed a part of Mexico, but declared its independence in 1835-6, and in 1846 was admitted into the Union as a state. There are 254 counties. The legislature is bicameral, comprising a Senate (31 members, one-half elected biennially for four years) and a House of Representatives (up to 150 members, elected biennially). 2 Senators and 21 Representatives are sent to Congress.—BIBLIOGRAPHY: G. P. Garrison,

[1] The Rio Grande del Norte rises in Colorado (San Juan Mountains), flows southwards through New Mexico, and bends south-eastwards to form the Texas-Mexican (Chihuahua-Coahuila) frontier for a distance of 1350 miles, falling into the Gulf of Mexico after a course of about 2200 miles.

Texas (an historical treatise); C. W. Raines, *Bibliography of Texas*; F. W. Simonds, *Geography of Texas*.

TEXEL. An island of the Netherlands, in the province of North Holland, at the entrance of the Zuider Zee, and separated from the mainland by the narrow channel of Marsdiep. The island furnishes excellent pasture for sheep, and it is noted for cheese made from sheep's milk. The northern part is famous as a haunt of sea-birds. The capital is Burg. Area, 71 sq. miles; pop. 6030.

TEZCU'CO, or TEXCOCO. A town of Mexico, in Mexico state, on the eastern shore of the Lake of Tezcuco (salt); served by rail to Mexico City. Under the name of Akolhuacan, Tezcuco was a chief seat of Aztec culture. Pop. 5930.

THACKERAY, William Makepeace. English novelist, born at Calcutta, 18th July, 1811, and died on Christmas Eve, 1863. His father came of an old Yorkshire family, and was an Indian civil servant. He died when Thackeray was only five years old, and Thackeray's mother married Major Henry Carmichael Smyth, who was to some extent the model for Colonel Newcome. In 1817 Thackeray was sent to England for his education; on his way home the ship touched at St. Helena, and he saw Napoleon at Longwood. After attending several private schools, he was sent to Charterhouse, where he remained for six years. He was too sensitive to be happy at school, and spoke of it as "Slaughterhouse," though time softened the memories of his boyhood.

In 1829 Thackeray went up to Trinity College, Cambridge, in a byterm. He did not distinguish himself, and went down without taking a degree; but he made many friends, among them being Monckton Milnes, Spedding, Fitz Gerald, and W. H. Thompson. He also wrote a burlesque poem on *Timbuctoo*, the subject set for the chancellor's English medal which Tennyson won. He had an independent income of about £500 a year, and was for a time able to follow his inclinations of travelling and studying art. He travelled in France and Germany; visited Weimar, where he saw Goethe, and settled at Paris for a time.

He entered the Middle Temple in 1831, but, although he was called to the Bar in 1848 in order to qualify for a post which he did not obtain, he never studied law seriously. He gradually became aware that art was not his vocation, and, having lost almost all his money in some unfortunate speculations and in the failure of an Indian bank, adopted literature as a profession. He was at one time the Paris correspondent of *The Constitutional*, and later (1837-8) he was connected with *The Times*. In 1836 he married Isabella Shawe; his brief married life was an ideally happy one, but it came to an end in 1840, when his wife's mind failed after the birth of a daughter. Thackeray was left virtually a widower with two young daughters. Mrs. Thackeray did not die until 1894.

Thackeray now undertook literary work of all kinds. Under the names of George Fitz-Boodle, Esq., or of Michael Angelo Titmarsh, he contributed to *Frazer's Magazine* tales, criticisms, and verses, which were marked by keen irony and great

William Makepeace Thackeray

knowledge of the world. In this magazine *The Great Hoggarty Diamond* appeared; and also *Barry Lyndon*, an unsuccessful imitation of Fielding's *Jonathan Wild*. In 1840 he published *The Paris Sketch-book*, and in 1843 *The Irish Sketch book*. In 1841 *Punch* first appeared, and Thackeray wrote much for it, to the great benefit of both the periodical and himself. *Jeames's Diary* and *The Snob Papers* both came out in *Punch*; the latter reappeared in book form as *The Book of Snobs*, and is an example of the author at his best.

Novels. Thackeray did not, however, reach the front rank of living novelists until 1847, when *Vanity Fair* was published in monthly parts, with illustrations by the author. This "novel without a hero" is one of the greatest of British novels, in spite of the insipidity of its heroine, and the clumsiness of its nearest approach to a hero. Thackeray's next long story was *The History of Pendennis* (1850), a novel which is partly autobiographical, and less well-constructed

than its predecessor. In 1851 he delivered a course of lectures in London on the English humorists of the eighteenth century; this course was repeated in Scotland and America before large audiences, and published in 1853. These lectures, which were undertaken mainly with the laudable object of providing for his family, are vivacious rather than soundly critical.

His next novel was *The History of Henry Esmond* (1852), which is considered by many critics to be his masterpiece. It is certainly a wonderful historical novel, unequalled in style and in the vividness of its portraits. Its sequel, *The Virginians* (1859), is, like the majority of sequels, disappointing. *The Newcomes* (1855) is a somewhat desultory novel of family life, redeemed by the figure of Colonel Newcome and the brilliance of some of its scenes. His remaining novels are: *Lovel the Widower* (1860), *The Adventures of Philip* (1862), and the fragmentary *Denis Duval*, left unfinished at his death.

In 1855-6 he gave a series of lectures in the United States; he repeated them in England and Scotland, and published them as *The Four Georges*. These lectures are entertaining at the expense of accuracy. In 1857 Thackeray was Radical candidate for Oxford city, and was defeated by a small majority. In 1859 he became editor of *The Cornhill Magazine*, but did not hold the post long, as he was too tender-hearted in his dealings with would-be contributors. His last three novels, together with a series of gossiping articles called *Roundabout Papers*, came out in this magazine. His other works are too numerous to mention, but include *Mrs. Perkins's Ball*, *Rebecca and Rowena*, and *The Rose and the Ring*. His verses are always graceful and finished, and sometimes rise into poetry.

Appreciation. Thackeray stands among the greatest of British novelists. It is a commonplace of criticism to compare or contrast his work with that of Dickens. The names of the two great novelists are joined together almost as inseparably as those of Castor and Pollux, though in truth they have nothing in common save that they were contemporaries and great writers. To some extent Dickens followed the Smollettian tradition, while Thackeray took the more ambitious course of following Fielding. In neither case did the more recent author surpass his model. But although Thackeray is not the peer of "the prose Homer of human nature," he has depicted the society of his time in the most masterly fashion, and has, in addition, made the age of Queen Anne live once more by the magic of his pen.—BIBLIOGRAPHY: Lewis Melville, *William Makepeace Thackeray: a Biography*; Anthony Trollope, *Thackeray* (English Men of Letters Series); H. C. Merivale and Sir F. T. Marzials, *W. M. Thackeray*; C. Whibley, *William Makepeace Thackeray*; M. H. Spielmann, *The History of Punch*.

THALAMIFLORÆ. That subdivision of polypetalous dicotyledons in which the flowers are hypogynous.

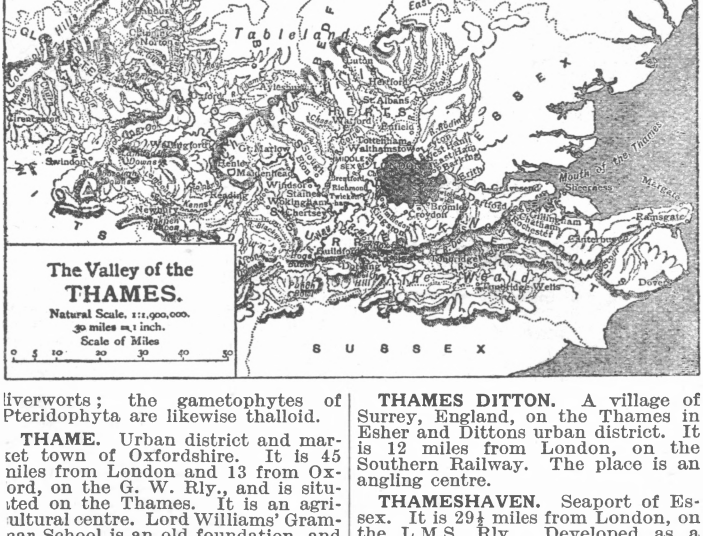
THALES (thā'lēz). The earliest philosopher of Greece, and the founder of the Ionian school, born about 640 B.C., died about 548 B.C. He was a native of Miletus, in Ionia, and is supposed to have been of Phœnician descent. He is said to have made several visits to Egypt, where he received instructions from the priests, from whom he probably acquired a knowledge of geometry. After his return his reputation for learning and wisdom became so great that he was reckoned among the seven wise men, and his sayings were held in the highest esteem by the ancients. His philosophical doctrines were taught orally, and preserved only by oral tradition, until some of the later Greek philosophers, particularly Aristotle, committed them to writing. He considered water, or rather fluidity, the elemental principle of all things, and maintained that every natural object had its fluid principle which contributed to its preservation.

THALLIUM. A metallic element (symbol, Tl; atomic weight, 204) discovered by Crookes, in 1861, in a deposit from a sulphuric acid manufactory in the Hartz. In its physical properties thallium resembles lead, but is slightly heavier, somewhat softer, and may be scratched by the finger-nail. It melts at 301° C., and is soluble in the ordinary mineral acids. In colour it resembles silver, but is less brilliantly white. Its specific gravity is 11·9. The tenacity of the metal is less than that of lead; it is possessed of very considerable malleability.

Thallium and its salts impart an intense green colour to a non-luminous flame; when a flame so coloured is examined by the spectroscope, one very brilliant green band is noticed, somewhat more refrangible than the sodium line D (*see* SPECTRUM). The salts of thallium are exceedingly poisonous. It forms two oxides, Tl_2O and Tl_2O_3, giving rise respectively to *thallous* and *thallic* salts. Small quantities of thallium are widely distributed in nature, the metal frequently occurring in iron and copper pyrites, in native sulphur, etc.

THALLOPHYTES, or **THALLOPHYTA.** The lowest sub-division of the vegetable kingdom, including the Algæ and Fungi, and certain minor groups, such as the Bacteria and Cyanophyceæ. The plant-body may be unicellular, cœnocytic, filamentous, or solid, but always remains a thallus (q.v.).

THALLUS. In botany, the term applied to a plant-body which shows no clear distinction of stem and leaves. It may take the form of a branched or unbranched filament, a cœnocyte (q.v.), a flat plate, or a solid mass of cells. It is found in all the Lower Plants or Thallophytes, and in some liverworts; the gametophytes of Pteridophyta are likewise thalloid.



THAME. Urban district and market town of Oxfordshire. It is 45 miles from London and 13 from Oxford, on the G. W. Rly., and is situated on the Thames. It is an agricultural centre. Lord Williams' Grammar School is an old foundation, and the Spread Eagle is a famous inn. Near is **Thame Park.** Pop. (1931), 4019.

THAMES (temz). The chief and longest river of Great Britain. It is properly formed by the Isis, Churn, Colne, and Leach, which have their sources on the east side of the Cotswold Hills and unite near Lechlade. From Lechlade, where it becomes navigable for barges, it flows past Oxford and Abingdon to Reading, Great Marlow, and Windsor to Staines. From Staines it passes Chertsey, Kingston, Richmond, and Brentford, separating the counties of Middlesex and Surrey, and passing through London. Below London its course eastward to the Nore, between Kent and Essex, is 47 miles. Its total course is estimated at 210 miles. Its tributaries include the Windrush, Cherwell, Thame, Colne, Brent, Lea, and Roding, on the left; the Kennet, Loddon, Wey, and Mole, on the right. At London Bridge the width of the river is 280 yards; at Woolwich, 490 yards; at Gravesend, 800 yards; and 3 miles below, 1290 yards. The basin of the Thames has an area of 5400 sq. miles. The tide ascends to Teddington.

THAMES DITTON. A village of Surrey, England, on the Thames in Esher and Dittons urban district. It is 12 miles from London, on the Southern Railway. The place is an angling centre.

THAMESHAVEN. Seaport of Essex. It is 29¼ miles from London, on the L.M.S. Rly. Developed as a centre for the storage of oil, it has wharves and other accommodation for the landing of the fuel. Pop. 500.

THANA. A maritime district and town of the northern division of Bombay Presidency, India. The district borders the Arabian Sea, and produces rice as a staple. The town is the district headquarters, and is on the Great Indian Peninsula Railway. Area, 3570 sq. miles; pop. (district), 882,000; (town), 22,639.

THANE (A.-S. *thegn*, O.H.G. *degen*, soldier, servant). A title of honour

among the Anglo-Saxons. In England a freeman not noble was raised to the rank of a thane by acquiring a certain portion of land—five hides for a lesser thane—by making three sea-voyages, or by receiving holy orders. Every thane had the right of voting in the witenagemot, not only of the shire, but also of the kingdom, when important questions were to be discussed.

With the growth of the kingly power the importance of the king's thanes (those in the personal service of the sovereign) rose above that of the highest gentry, ealdormen and bishops forming an inferior class. On the cessation of his actual personal service about the king the thane received a grant of land. After the Norman Conquest, thanes and barons were classed together. In the reign of Henry II. the title fell into disuse. In Scotland the thanes were a class of vassals of the Crown, and the title was in use till the end of the fifteenth century.

THAN'ET, ISLE OF. A district of Kent, England, at the mouth of the Thames, separated from the mainland by the Stour, and generally referred to as an "island;" area, 18,639 acres. It is noted for its bracing air. The chief towns are Margate, Ramsgate, and Broadstairs, all frequented for sea-bathing, also Ebbsfleet. Pop. (1931), 14,420.

THANET BEDS. The geological name for the lowest division of the Eocene in Great Britain. It is found in Thanet, and in it are many marine fossils.

THANKSGIVING DAY. Holiday in the United States. It began in New England as a thanksgiving for the harvest. In the nineteenth century it was made a general holiday. The last Thursday in November was chosen and since 1864 this has been a general holiday.

THANN (tán). A town of France, in the department of Haut-Rhin (Alsace), on the Thur. It is an industrial town noted for wine. Pop. 7500.

THAPSACUS. An important city of ancient Syria, on the right bank of the Euphrates between modern Meskene and the confluence of the Belikh, identified with the *Tiphsah* (from a Semitic word meaning "crossing") of 1 Kings, iv., 24, which was the northern frontier town of Solomon's kingdom on that side of the Euphrates. *Thapsacus* was the lowest ford of the river, and was used by Cyrus (the younger), and by Darius, who crossed it to meet Alexander at Issus, but was defeated and fled across the ford, pursued by Alexander. Alexander, however, crossed by two bridges, which are assumed to have been bridges of boats. *Tiphsah* of 2 Kings xv., 16, was in Palestine, and its location is unknown.

THAR AND PARKAR. A district of India, in Eastern Sind, bordering the Rann of Cutch. Rice, cotton, tobacco, hemp, wheat, barley, melons, etc., are raised. Muslims (58 per cent) and Hindus (41 per cent) predominate. There are three municipalities, Umarkot (the chief town), Mithi, and Mirpur Khas. Area, 13,941 sq. miles; pop. 457,000.

THARRAWADDY. A district and town in the Pegu division of Lower Burma. The district meets the Irrawaddy on the west, and is mainly a flat alluvial plain producing rice, peas, tobacco, sesamum, sugar-cane, vegetables, maize, and orchard produce. The town is the district headquarters, and is on the Rangoon-Prome Railway. It is more or less a suburb of Thonze. Area, 2851 sq. miles; pop. (district), 492,429; (town), 3625.

THASOS. The most northerly island in the Ægean Sea, a few miles south of the Macedonian coast; area, 150 sq. miles. It is afforested, and produces timber, oil, and honey. It belongs to Greece. Pop. 12,000.

THAXTED. Village of Essex. It is 42 miles from London, by the L.N.E. Rly., and has an interesting old church. Pop. (1931), 1596.

THE'ATINES. An order of monks founded at Rome in 1524 by Gianpietro Caraffa (Pope Paul IV.), Archbishop of Chieti, in Naples (ancient *Theate*). They bound themselves to preach against heretics, attend the sick and criminals, and not to possess property or ask for alms.

THEATRE (Gr. *theatron*, a place for seeing). Now denotes, apart from certain particular uses, usually metaphorical, a place where plays are acted and witnessed.

Greek. The origin of the Greek drama being the choric dances in honour of Dionysus, the Greek theatre was shaped by the developments in that religious festival. The earliest feature was the circular, flat "orchestra," or dancing place, with the altar of the god in the centre. This remained the determining factor in the form of the Greek theatre, though it was modified as time went on through the increased importance of the play and the actors (*see* STAGE). As the spectators could see best when ranged above the "orchestra," it was placed at the foot of a slope. On the slope above it, in the earliest times, the spectators stood or lay; then wooden benches were provided for

them, and later tiers were hollowed out of the hill-side and fitted with seats of stone or marble, the lowest tiers being reserved for priests and officials. The tiers were curved, and, owing to the slope of the ground, came to an end on either side of the "orchestra," making, roughly, two-thirds of a circle, so that the spectators could watch the play from three sides, not four. The performances were given in the open-air. Among the chief remains of Greek theatres are that at the foot of the Acropolis at Athens and that at Epidaurus.

Roman. The Romans, who derived most of their culture from Greece, adopted the Greek form of the theatre, but altered it to suit a drama that had no direct descent from a sacred dance. The "orchestra" not being needed for dancing, a segment of it, sometimes amounting to one-half, was cut off by the proscenium or stage-front, and the other portion was used for seating senators and other important people. The semicircular form of the theatre as a whole, with the curved tiers of seats, was in most cases retained; and the theatre had no roof, though an awning was frequently stretched over the auditorium; but whereas the Greeks had hollowed their theatres out of the hill-side, the Romans took to constructing theirs, occasionally, on a flat surface. Interesting remains of Roman theatres may be seen in Provence, as at Orange, Arles, and Vaison.

The Roman theatre, where plays were acted, was distinct from the amphitheatre (*amphi-theatron*, the place where you may see from all sides), the great circular or oval buildings surrounding the arena used for gladiatorial fights, animal contests, and other spectacles, as at the Colosseum in Rome, and the arenas at Nîmes, Arles, and other places in Southern France.

English. The Italian and the French theatres were in the main developments from the classical theatre of Greece and Rome. The direct descent of the English theatre must be traced to other origins. The earliest English theatres were the church, where at certain festivals the clergy would act brief liturgical plays, and the great hall in the house of a nobleman, where wandering minstrels and troupes entertained the company. The liturgical plays proved so popular that, still in the Middle Ages, the church became too small for them. The plays grew in scope, and were performed either on a temporary platform erected in the churchyard or in the central space of the town, or else on movable stages or "pageants," in each of which was acted a portion of the complete "cycle" of religious dramas making up a "miracle," the pageants being wheeled from point to point of the town in succession, so that each set of spectators might see the whole cycle (*see* STAGE).

The Reformation militated against the religious drama; meanwhile the secular drama had slowly been growing in favour. Plays were acted with increasing success in the halls of great houses, palaces, colleges, and Inns of Court, also in the yards of inns, which were open spaces where the spectators could stand about a platform erected in the middle, and where the galleries that ran round the walls afforded space for those who did not care to mingle with the crowd. To these influences must be added yet another —the circular spaces, or "rings," for bull-baiting and bear-baiting, some of which (as may still be seen in certain old English towns) were spaces left for the purpose amid the houses, while others (those, for instance, on the Bankside, the south bank of the Thames at Southwark) were specially built amphitheatres. The growth of the English theatre involved all these elements; but the fact that the first English playhouse was, properly speaking, an amphitheatre, must be ascribed chiefly to the convenience of that shape, as proved by the inn-yards and the bull-rings.

In the reign of Elizabeth, Puritan opposition to the rapidly growing drama was so active, from considerations of public health and security as well as from religious and moral feeling, that the public performance of plays was forbidden within the City of London. It occurred, therefore, to James Burbage, once a joiner by trade and then a member of the Earl of Leicester's theatrical company, to build near to London, yet outside the jurisdiction of the city fathers, a place where plays could be publicly acted. He chose Finsbury Fields, a public playground outside the walls on the north of the city, and put up there in 1576 his playhouse, the Theater, a circular wooden building with galleries all round it and an open arena on the ground, still called "the yard" after the inn-yards. The circle was broken only at one point, where the stage (a movable platform on trestles) projected into the yard. There was standing room for "the groundlings" or populace on three sides of the stage, and the galleries for the more select spectators ran round the walls and alongside of and behind the stage, occupying part of the "tiring-house," or actors' dressing-rooms. The theatre was open to the sky; and above the tiring-house rose a tower on which a flag was

flown when a play was being acted.

The English public playhouse naturally developed and changed between 1576 and the closing of the theatres in 1642; but certain features remained constant. All were circular, polygonal, or oval, and constructed principally of wood. In all, the stage projected into the yard, so that the play could be seen from three sides; in all, the galleries were reserved for those who would pay extra for seats in the "rooms" or boxes into which they were divided; and in all, the plays were given by daylight.

The Theater was quickly followed by the Curtain, named from the Curtain estate in Finsbury, where it stood; and the other public playhouses of the reigns of Elizabeth, James I., and Charles I. were: the Playhouse, at Newington Butts; the Rose, on the Bankside; the Swan, in the same district (see DRAMA for a contemporary drawing of the interior); the Globe, which was the playhouse of Shakespeare and his company, built on the Bankside in 1599 by Richard and Cuthbert Burbage, the sons of James Burbage, mainly out of the materials of the old Theater; the Fortune, on the Bankside; the Red Bull, in Clerkenwell; and the Hope, on the Bankside.

Besides these public playhouses there were a number of "private" playhouses, which were only private in the sense that they were in practice reserved for the entertainment of the higher social ranks. In these we see the influence of the hall of the palace, college, or Inn of Court, where plays were acted upon the dais at one end. The private playhouse was a roofed hall, rectangular in shape, with the stage at one end. The audience was placed at the opposite end and round the walls. Some of these playhouses had galleries, and the lighting was by means of windows, supplemented, especially for stage effects, by candles. The most eminent private playhouse in London was the Blackfriars. There were three of this name within the precincts of the ancient Dominican monastery on the north bank of the Thames. The first and smallest was the theatre of the Children of the Chapel, the boys of the Royal choirs; the second was occupied by Burbage, Shakespeare, and the Globe company in the winter. Others were the Whitefriars; the Phœnix, or Cock Pit, in Drury Lane; and the Salisbury Court, in Whitefriars.

In 1642 all playhouses were closed by law. On the Restoration theatrical activity broke out anew, but was limited by the patents, or monopolies, granted by King Charles II. to Sir William D'Avenant and Thomas Killigrew, the effect of which was that there were, in principle, only two theatres in London. In 1660 Killigrew built a new theatre in Vere Street, Clare Market; in November of that year D'Avenant opened at the old "private" playhouse in Salisbury Court, moving in 1661 to a new theatre in Portugal Street, Lincoln's Inn Fields, and in 1662 to a new and splendid theatre in Dorset Gardens. Killigrew, in 1663, opened the first Theatre Royal, Drury Lane; in 1672 the house was burned down, and the new one, designed by Sir Christopher Wren, was opened in 1674. This—the theatre of Garrick—was pulled down in 1791 and rebuilt, only to be burned to the ground in 1809. Once more rebuilt, it has undergone great alterations since that date.

In 1732 Covent Garden Theatre was built on the site of the present Opera House, and for about a century (Dorset Gardens having been deserted) this theatre shared with Drury Lane the theatrical monopoly of London. This house was burned down in 1808 and rebuilt. About 1720 the "Little Theatre in the Haymarket" (so called to distinguish it from the opera house built and opened in 1705 by Sir John Vanbrugh, architect and playwright, on the opposite side of the street, where His Majesty's Theatre now stands) was opened close to the site of the present Haymarket Theatre; and this was used, by Royal licence, chiefly in the summer months when the two "patent houses" were closed. Other theatres existed; among them the Goodman's Fields Theatre in Ayliff Street, City, opened in 1729, and rebuilt in 1732, where in 1741 Garrick made his first appearance. But such theatres had no legal status, and existed only on sufferance.

In 1737 the Licensing Act, called into being through the freedom with which dramatists, and especially Henry Fielding, were attacking the Government, made it possible for these unauthorised theatres to obtain an annual licence under stringent conditions. By complying with the provisions of the Act such theatres as Sadler's Wells (opened in 1765), the Surrey, the Olympic, and the Adelphi could attain a certain measure of security; but the two patent houses were constantly using their power to prevent rivalry from the "minor" theatres, as they were called, and to hamper their efforts. In 1787 a determined effort was made by the actor John Palmer to maintain an unlicensed theatre called the Royalty in Wellclose Square, near the Tower of London; but the patent houses succeeded in having the theatre shut.

In the "minor" theatres perfor-

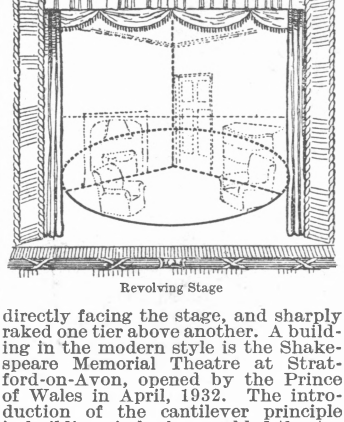
mances of the legitimate drama were impossible, save by subterfuge and under disguise, or at the risk of interruption and penalty. Certain prominent theatres, however, among them those at Bath, Bristol, and Edinburgh, were granted the Royal patent in the reign of King George III. In 1843 an Act of Parliament deprived the patent houses of their monopoly. The legitimate drama was thrown open to all, subject to the licensing of every new play by the Lord Chamberlain; and very soon there was, in London and elsewhere, a great increase in the number of theatres.

In form the theatre of the Restoration carried on traditions from both the public and the private playhouses of the Elizabethan age. The drama came indoors altogether, for though the pit of Killigrew's first theatre in Drury Lane was open to the sky, it was soon covered with a glass roof. Plays were still given in the daytime, but artificial light was freely used. The theatre remained almost an amphitheatre, as the stage projected into the yard (then newly called the pit), so that people could stand or sit on three sides of it, and the galleries and boxes extended over it on either side. The pit was still the cheapest part of the house, frequented by the populace, and also by the amateur and professional critics; but the highest gallery, above the circle or circles entirely given up to boxes, began to take its place, and the social status of the pit was raised. This was partly due to the gradual substitution of the "picture stage" for the "platform stage" (*see* STAGE), which made the stage visible only from in front and increased the size of the pit.

Benjamin Webster, during his management of the Haymarket Theatre (1837-53), was the first to introduce higher-priced seats, called pit-stalls, or now more commonly orchestra-stalls, between the stage and the pit seats; and at the same theatre Mr. and Mrs. Bancroft, on opening their management there in 1880, abolished the pit, and gave the whole of the ground-floor to stalls—an innovation which was resented by the public and abandoned.

The component parts of the modern auditorium are, in nearly all cases, the stalls and the pit behind them, occupying the ground floor; a circle called the dress circle, with one or two private boxes at either end nearest the stage; above it, usually found in the older theatres, another circle, the upper circle, often called by the old name of the "upper boxes;" and above that the gallery. Of recent years there has been a tendency to relinquish the curved, or horseshoe, design in the circles in favour of the rectangular. The fronts of the circles are brought out nearer the stage, and cross the theatre in a straight or very slightly curved line from wall to wall. This increases seating capacity, and obviates the need of more than two circles. Some modern theatres are rectangular in shape, and have either no circles or galleries, or a very small one at the back, as in the Little Theatre, London.

The Birmingham Repertory Theatre, opened in 1913, is a good example of a theatre built on a German design: a rectangle divided into a ground-floor and one very deep gallery, each occupied by straight tiers of seats



Revolving Stage

directly facing the stage, and sharply raked one tier above another. A building in the modern style is the Shakespeare Memorial Theatre at Stratford-on-Avon, opened by the Prince of Wales in April, 1932. The introduction of the cantilever principle in building circles has enabled theatre architects to do away with pillars and other obstructions in the auditorium; and it is now possible for spectators in the remotest seats to see and hear with ease.

Lighting effects also have been greatly improved, and another modern development is the revolving stage, which enables a new scene to be set up while the play is in progress.

BIBLIOGRAPHY: A. E. Haigh, *The Attic Theatre*; K. Mantzius, *History of Theatrical Art*; A. W. Pollard, *English Miracle Plays*; E. K. Chambers, *The Mediæval Stage*; H. Child, *The Elizabethan Theatre* (in *Cambridge History of English Literature*, vol. vi.); W. J. Lawrence, *The Elizabethan Playhouse and other Studies*; J. A. Adams, *Shakespearean Playhouses*; R. F.

Sharp, *Short History of the English Stage*; W. Nicholson, *The Struggle for a Free Stage in London*.

THEBAINE ($C_{19}H_{21}NO_3$). A very poisonous alkaloid present in small quantity in opium. It occurs in prismatic crystals of melting-point 193° C., which are nearly insoluble in cold water. It is closely related to morphine and codeine.

THEBES (thēbz). An ancient capital of Egypt, in Upper Egypt, on both sides of the Nile, now represented by the four villages of Luxur, Karnak, Medinet Habu, and Kurneh, as well as by magnificent ruins, which extend along the river. The old Egyptian name of Thebes was *Weset*, but in later times it was also called *Nu(t) Amen*, the city of Ammon,[1] or *Nu(t) ŏ*, the great city; in the Old Testament it is called *No*, or *No Amon* (Nahum, iii., 8; Jer. xlvi., 25; Ezek. xxx, 14, 15, 16); in the Assyrian Inscriptions it is called *Nî*. By the Greeks it was sometimes called *Diospolis*.

When Thebes was founded is not known; the period of its greatest prosperity reaches from 1500 to 1000 B.C. During the reign of Akhenaten (Amenhotep IV.) the capital was removed to (modern) Tell al-Amarna, or Akhetaten, where the king established a sun-cult, worshipping the *Aten* or Disk and assuming the name of Akhenaten. One of his three daughters, named Ankhesenpaaten, subsequently married Tutankhaten, later called Tutankhamen (q.v.), who ruled for a time in Akhetaten but eventually returned to Thebes.[2]

The ruins comprise magnificent temples, rock-cut tombs, obelisks decorated with beautiful sculptures, long avenues of sphinxes, and colossal statues. Above Karnak are the village and temple of Luxor, the latter at one time connected with Karnak by an avenue of sphinxes (some of which still remain) about a mile long. The Memnonium or temple of Rameses II., and the temple and palace of Rameses III., on the other or left bank of the river, are objects of great interest, both for the grandeur of their architecture and the richness and variety of their sculptures. There are also the colossal statues of Amenoph III., one of them known as the vocal statue of Memnon. In the valleys of the mountains which rise behind are found the tombs of the kings, queens, and dynastic functionaries of Egypt, excavated in the living rock.

THEBES (Gr. *Thebia*). A city of ancient Greece, the principal city of Bœotia, the birth-place of Pindar, Epaminondas, and Pelopidas. It was situated about midway between the Corinthian Gulf and the Eubœan Sea. Cadmus is said to have founded it in 1500 B.C., and in the legendary days of Greece it was associated with Heracles and Dionysus. It lost much of its influence in Greece through its perfidious leagues with the Persians. Under the brilliant leadership of Epaminondas and Pelopidas it became the leading state in Greece, but its supremacy departed when the former fell at the battle of Mantinea (362 B.C.). From this time the city never recovered its former importance, and gradually disappeared from history.

THEFT. The appropriation of another's property to one's own use without the owner's consent. There cannot be theft of an object which has no owner, e.g. of a wild animal or of a thing which has been abandoned; but if an owner exists, though he be not known, as when an article has been lost but not abandoned, appropriation may constitute theft. Felonious intent (the "animus furandi") is an essential element in the crime, and so it is not theft to take the use (say) of another's bicycle or of another's horse if throughout there is the intention to return it.

Appropriation, i.e. taking possession, is also a necessary element. It is present if the article has merely been moved from its position with felonious intent, though the thief has been prevented from taking it away, e.g. when a watch is snatched out of the pocket of its owner but the chain holds and prevents the thief getting away with it. The true owner of stolen property can recover it even from an innocent purchaser, but in England this rule is qualified by the doctrine of "market overt," whereby, generally speaking, a purchaser in open market who has no notice of the theft acquires a good title to the stolen property which he has thus purchased. If the theft be from the person and accompanied by threats of violence, it is the more heinous crime of robbery. Theft is punishable by fine, imprisonment, or penal servitude according to the nature and circumstances of the crime. *See* LARCENY.

THEISM. The belief in a conscious, spiritual, ultimate reality. Etymologically, the term theism ought to be applied to the theory which affirms the existence of a divinity, irrespective of the question as to the nature of that divinity. It would thus include the doctrines of *monotheism*, *dualism*, *pantheism*, and even *polytheism*.

In philosophical language, however,

[1] *Ammon* is the Hellenised form of the Egyptian *Amen*.

[2] See *Tell al-Amarna*.

the term theism is only applied to the belief in an intelligent author and creator of the universe, who is not only extra-mundane, but also the providence of the world. It is the theory which explains the universe as the work of one infinite and absolute Being. Professor Flint defined theism as the "doctrine which maintains that the universe owes its existence and continuance in existence to the reason and will of a self-existent Being, who is infinitely powerful, wise, and good." Philosophically, therefore, theism is the doctrine that the ultimate ground of things is a single supreme reality.

Religiously, theism is the belief in a supra-human object of worship, a Supreme Being who is at once the author, governor, and Providence of the world. It maintains not only the transcendence of God, but His immanence and agency in the world, and assumes a living constant relation between God and His creatures. It is opposed to atheism and pantheism, and is to be distinguished from *deism* (q.v.), which is natural religion and is hostile to revelation, tradition, and religious worship.

The term theism came to be used in England in the seventeenth century in contrast with deism, and in opposition to atheism. Bayle wrote in 1705: "je me sers de ce mot à l'imitation des Anglais." Greek philosophy was, generally speaking, theistic, i.e. it explained the world by assuming an absolute Being as a unifying ground of things, and a first principle. This theistic trend of thought runs through the philosophy of Plato and Aristotle, and of the Neo-Platonists.

The thinkers of early Christianity, and the Schoolmen, such as Anselm and Abelard, were decidedly theists. Descartes, if we bear in mind the distinction between theism and deism, was a deist, and *not* a theist. Kant, in his *Critique of Pure Reason*, distinguished between the deist and the theist by saying that the former believes in God, whilst the latter believes in a living God (*summam intelligentiam*). Lotze in Germany, and Martineau and Caird in England were theists, whilst William James, the champion of pluralism (q.v.), considers theism as the "only conception of God which will satisfy our emotional and volitional nature."

With regard to the proofs adduced in favour of the existence of God, they have been: (1) *cosmological*, arguing from the existence of a dependent world to an independent cause; (2) *teleological*, arguing from the evidences of plan and design in the world to the existence of a First Cause which is a rational personality; (3) *moral*, arguing from the nature of man himself as a moral being to that of God; and (4) *ontological*, maintaining that it is inconceivable that the conception which man forms of God should be a mere subjective creation.—BIBLIOGRAPHY: R. Flint, *Theism*; G. J. Romanes, *Candid Examination of Theism*; A. J. Balfour, *Theism and Humanism*.

THEISS (now **TISA**, or **TISZA**). A river of Central Europe, formed by the confluence of the Black and the White Theiss, descending from the Carpathians, and flowing into the Danube about 20 miles above Belgrade; length, about 870 miles. Its principal tributary is the Maros, which joins it near Szeged, and which is navigable by steamers as far as Arad.

THELEPHORACEÆ. A family of basidiomycetous Fungi, having membranous or leathery fruit-bodies of various shapes. *Thelephora terrestris* sometimes overwhelms Conifer seedlings. Stereum is another genus.

THEMIS, goddess of law and justice among the Greeks, was, according to the Hesiodic theogony, the daughter of Urănus and Gĕ (Heaven and Earth). According to Pindar, she was the wife and chief adviser of Zeus.

THEMIS'TOCLES (-klēz). Athenian statesman, born 514 B.C., died 449 B.C. On the second invasion of Greece by Xerxes, Themistocles succeeded by bribery in obtaining the command of the Athenian fleet, and in the battle of Salamis which followed (480 B.C.), the Persian fleet was almost totally destroyed, and Greece was saved. The chief glory of the victory is due to Themistocles. Subsequently he was accused of having enriched himself by unjust means, and of being privy to designs for the betrayal of Greece to the Persians. Fearing the vengeance of his countrymen, he, after many vicissitudes, took refuge at the Persian court. The Persian throne was now (465 B.C.) occupied by Artaxerxes Macrocheir (Longimanus), to whom Themistocles procured access, and whose favour he gained by his address and talents, so that he was treated with the greatest distinction. He died, according to some accounts, by his own hand.

THE'OBALD (often pronounced tib'ald), **Lewis.** English man of letters and editor of Shakespeare, born about 1688, died in 1744. He was educated for the law, but early turned his attention to literature. Pope was meanly jealous of him, and ridiculed him in the first version of

The Dunciad. Theobald, however, had his revenge, his edition of Shakespeare (1733) completely supplanting Pope's. He did great service to literature by this painstaking work, many of his emendations being adopted by subsequent editors, and gaining for him the title of "splendid-emendax."

THEOC'RACY (Gr. *theos*, god; *kratein*, to rule). A system of government of which the chief is, or is believed to be, God himself, the priests being the promulgators and expounders of the divine commands. The most notable theocratic government of all times is that established by Moses among the Israelites.

THEOC'RITUS. The creator of pastoral poetry, lived in the third century B.C. Very little is known of his life, nor is that little beyond suspicion. He is said to have been the son of Praxagoras and Philinna, and to have been a Syracusan, or, as others say, a Coan settled in Syracuse. He was a pupil of the Homeric critic Philetas, who died of vexation because he could not solve a metaphysical enigma. It has been conjectured that Ptolemy Philadelphus was Theocritus's fellow-pupil, and that the poet owed to this a semi-official position as court-poet at Alexandria. It is believed that he returned to Cos and spent his latter days there. He died there at an advanced age.

Thirty poems (*Idylls*) have come down to us under the name of Theocritus. Some of these are without doubt spurious, and the authenticity of many of them has been called in question, not always for sufficient reasons. Style and treatment are uncertain tests of authenticity; a criticaster of A.D. 4200 could prove that *The Idylls of the King* and *The Northern Farmer* could not possibly be the work of the same man. As is natural, the most masterly poems are beyond question genuine.

The ancient arrangement of the poems is not a satisfactory one, but is too long established to be lightly altered. The poems may be divided into four classes: (1) Bucolics and mimes, the former being true pastorals, the latter realistic poems of contemporary town life. Sophron, whose works are lost, influenced Theocritus in the composition of his mimes. (2) Epyllia, or epics in miniature. Several of these are official poems, in praise of Hiero and Ptolemy. They are mere ormolu work in comparison with the pure gold of the pastorals. (3) Lyrics. One of these is a very graceful piece of occasional verse, which accompanied a distaff presented to the wife of his friend Nicias. (4) Epigrams. None of these is distinguished, and few are genuine.

Theocritus's great reputation rests upon his pastoral poems and his mimes. One of the latter, *The Women at the Adonis Festival*, has acquired a certain fame because it was translated by Matthew Arnold. This poem is wholly delightful, but is not typical of its author's genius, which is akin to that of Virgil or of Tennyson, not to that of Herodas (q.v.) or of Mr. F. Anstey. *The Spell*, the Second Idyll, is a poem of great power. *The Cyclops* is a fine poem, in which the Homeric cannibal roars as gently as any sucking dove.

But the purely pastoral poems, of which No. 7, *The Harvest Home*, is the most charming, are Theocritus's great contribution to poetry. Living in an age of grammarians and diaskeuasts, Theocritus struck a new and rich vein of genuine poetry. He has had many followers—Virgil, Calpurnius Siculus, Guarini, Mantuanus, Spenser, Gay, to name but a few—but none of them has equalled or even approached him in felicity of language, sweetness of song, and truth to nature. *See* PASTORAL.—BIBLIOGRAPHY: R. J. Cholmeley, *Theocritus*; P. E. Legrand, *Étude sur Théocrite*. There is an excellent verse translation by C. S. Calverley (q.v.), and a prose one by Andrew Lang. Much of the verse translation in the Loeb Library is in what the Host in *The Canterbury Tales* called "rym dogerel."

THEOD'OLITE. A surveying instrument invented by Jonathan Sisson, a celebrated mathematical-instrument maker of the beginning of the eighteenth century. The name theodolite is due to the English mathematician Leonard Digges, who described a simple form of the instrument in a work published in 1571. As now greatly improved, it is the most perfect instrument for measuring both horizontal and vertical angles and is employed in all important surveying work.

In the original type, called the *plain theodolite*, the telescope moved through an arc of about 45° only, upwards or downwards; in the later type, called the *transit theodolite*, the telescope may make a complete revolution. As the latter is now almost universally adopted, it is the one which will be described. The instrument when in use is mounted upon a very rigid tripod-stand, to which it screws. It consists of a powerful telescope trunnioned to make a complete revolution in a vertical plane, and supported in uprights which are

so mounted on centres as to allow it to make a complete revolution in the horizontal plane also. Both vertical and horizontal centres carry circles or limbs divided upon silver with the utmost attainable accuracy, and the readings of the various angles are taken by means of double concentric centres, one carrying the divided circles and the other carrying verniers.

The movements of the telescope in altitude or azimuth are read by microscopes mounted to move over the verniers, the fineness of the readings varying, with the size of the circles used, from 1 minute of arc with a 4-inch circle to 5 or 10 second with

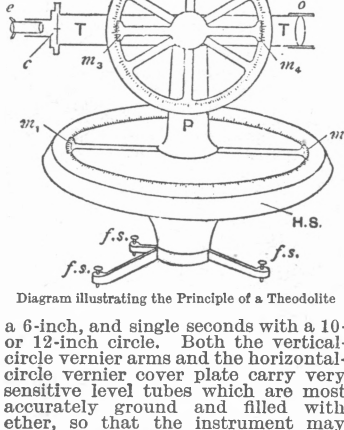
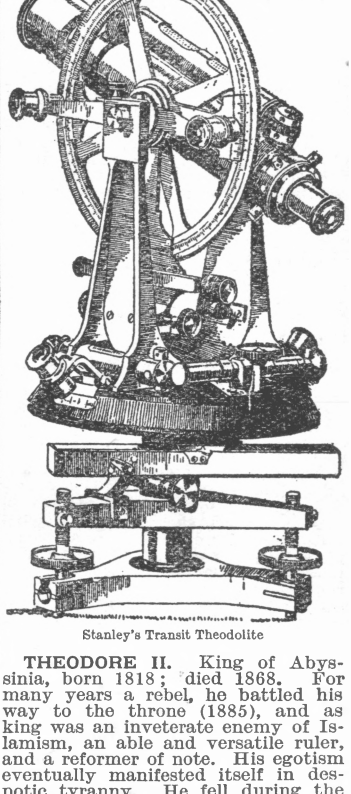


Diagram illustrating the Principle of a Theodolite

a 6-inch, and single seconds with a 10- or 12-inch circle. Both the vertical-circle vernier arms and the horizontal-circle vernier cover plate carry very sensitive level tubes which are most accurately ground and filled with ether, so that the instrument may be set up by means of the levelling screws absolutely horizontal and vertical, and all the movements of circles and telescope are controlled by clamps and tangent motions for fine adjustment.

The telescope is fitted with a diaphragm across which are stretched fine lines, usually pieces of spider's web, forming the index lines to which the readings are taken. A magnetic compass is attached for the purpose of orientation, and with high-class instruments a transverse stage is fitted above the levelling screws for accurately centring the instrument over a given spot. An illustration is given of the most usual form of simple field instrument. For high-class geodetic work a much more elaborate type of instrument is used.

THEODO'RA. The wife of the Byzantine emperor Justinian I. (q.v.), at one time a dancer on the stage, and notorious as a courtesan. She subsequently assumed the character of a pious benefactor of the Church, and died in 548, aged forty.



Stanley's Transit Theodolite

THEODORE II. King of Abyssinia, born 1818; died 1868. For many years a rebel, he battled his way to the throne (1885), and as king was an inveterate enemy of Islamism, an able and versatile ruler, and a reformer of note. His egotism eventually manifested itself in despotic tyranny. He fell during the storming of Magdala. *See* ABYSSINIA.

THEODORE OF MOPSUESTIA. The most distinguished ecclesiastical writer of his age, born at Antioch about A.D. 350; died in 428. He was ordained priest, and distinguished himself as a zealous opponent of the heresies of Arius, Apollinaris, and others. From Antioch he removed to Tarsus, and was chosen Bishop of

Mopsuestia, in Cilicia (about 392-4). Only a few fragments of his works, which included commentaries on almost all the books of the Bible and various polemical treatises, are extant. His doctrine approximated somewhat to that of Pelagius, and was later considered heretical.

THEOD'ORET. Greek Church historian and theological writer, born at Antioch about A.D. 386, died in 457. In 423 he became Bishop of Cyrus or Cyrrhus, was involved in the quarrel between Nestorius and Cyril of Alexandria, and was deposed at the so-called Robber Council of Ephesus, a sentence which was reversed by the General Council of Chalcedon in 451. The most important of his works consist of commentaries on numerous books of the Old Testament and on the Pauline epistles, *Ecclesiastical History*, *History of Heresies*, etc.

THEODOR'IC. King of the Ostrogoths, born A.D. 455; died 526. The son of Theodemir, King of the Ostrogoths of Pannonia, he lived from his eighth to his eighteenth year as a hostage with the Emperor Leo at Constantinople. Two years after his return he succeeded to the throne. In 493, after several bloody engagements, Theodoric induced Odoacer, who had assumed the title of King of Italy, to grant him equal authority.

The murder of Odoacer at a banquet soon after opened the way for the proclamation of Theodoric as sole ruler, and as such he ruled with great vigour and ability. He attached his soldiers by assigning them a third part of the lands of Italy, on the tenure of military service; while among his Italian subjects, whom he conciliated by introducing an improved administration of justice, he encouraged industry and the arts of peace. Although, like his ancestors, he was an Arian, he never violated the peace or privileges of the Catholic Church.

THEODOSIA. *See* FEODOSIA.

THEODO'SIUS. A Christian Roman emperor, born in Spain about A.D. 346; died at Milan in 395. In 379 he was selected by the Emperor Gratian for his partner in the empire. To his care were submitted Thrace and the eastern provinces, which he delivered from an invasion of the Goths. On the defeat and death of Maximus (388), Gratian having previously been killed, Theodosius became the sole head of the empire.

In 390, as punishment for a revolt in Thessalonica, he caused the people of the city to be invited to an exhibition in the circus, and, once there, 7000 of them perished at the hands of his soldiery. St. Ambrose refused him communion for eight months on account of this crime, and Theodosius submitted humbly to the punishment. He died of dropsy, leaving the eastern portion of the empire to his son Arcadius, the western to his son Honorius. Theodosius distinguished himself by his zeal for orthodoxy.

THEOGNIS OF MEGARA. Greek elegaic poet, lived in the sixth century B.C. Very little is known of his life, though several imaginative biographies of him have been written. What we do know of him is mainly derived from the poems (some 1400 lines in all) that have come down to us in his name. There is no doubt, however, that many of these poems are not his work, though authorities differ about which are genuine and which are not.

It seems certain that he lived at Megara in the disturbed times which followed the overthrow of the tyrant Theagenes, and that he was a keen party-politician, and a member of the ascendancy party. Oligarchy and democracy were engaged in a fierce struggle, members of the latter party demanding a παλιντοκία, or retrospective abolition of interest. Theognis was driven from the city, and visited Eubœa and Sicily.

Many of the poems of Theognis are addressed to one Cyrnus, who was, in accordance with a Dorian custom, his pupil or squire. For the most part they consist of precepts; they are in fact a kind of *Proverbial Philosophy* of the sixth century B.C. They are devoid of almost all the higher qualities of poetry; had Theognis lived at a later date he would almost certainly have written in prose. Xenophon has well said of him that "he discourses of nothing else but the virtue and vice of men, and his poetry is a Manual on Man, just as if anyone skilled in horsemanship were to write a Manual of Horsemanship."

His poems are full of practical wisdom, and, as might be expected, were favourite textbooks in schools. Among his sayings are, that poverty breaks the spirit of a noble man more than anything, more even than age or ague; and that at a dinner-party one should strike a happy mean between the two extremes of teetotalism and intoxication. He was one of the earliest eugenists, for he wrote: "We are careful to select the best race of horses and the like, but a noble man

doubts not about marrying a mean woman, if she bring him money."

THEOLOGY. Etymologically, the science of God, i.e. the reasoned study of the divine nature. This is its original sense, in Greek. But as the divine nature was regarded in all its relations to the world and to man, "theology" came to mean the reflective statement of religious realities. "Theology is religion brought to self-consciousness. It is the reflective analysis of the consciousness of God in its distinctive form, and in its connection with all our other consciousness of reality." (E. Caird, *Evolution of Theology in the Greek Philosophers*, vol. i., p. 31.).

Religion is the sphere in which theology operates. The data of the religious experience, the intuitions, emotions, and beliefs generated in the human mind by the idea of God, furnish the material for theology, which analyses and correlates and classifies them, in order to bring out what is implicit and to reach a unified view of their truth.

Theology thus presupposes a theory of knowledge, and all fruitful theology is connected with some philosophical view of reality. The important changes which have taken place in theology have been due in part to revivals in the practical religious experience, which have demanded new statement of belief; but they have also been the result of some fresh idea in philosophy which has affected the expression of religious truth.

How far theology is to be identified with the philosophy of religion is a debated question. The answer largely depends upon the range assigned to "theology." In the broadest sense of the term, theology becomes practically a philosophy of any given religion, developing the reasons for its beliefs and practices, and justifying, in terms of contemporary philosophy, its essential principles.

But the traditional division of "theology" and philosophy goes back to the assumption of a revealed supernatural content, and demands a narrower definition. Theology, in this sense, is the reasoned explanation of faith as the outcome of a divine revelation. It includes (*a*) *natural* theology, i.e. the religious truths about God which are accessible to the natural reason, secured by a survey of life and the world. From the data of nature and the moral life certain inferences are drawn as to the existence and character of God. Then (*b*) *revealed* theology amplifies this body of inferences by working upon the direct revelation of God in a sacred book or a sacred personality like that of Jesus Christ. (*c*) One branch of this is called *biblical* theology, since its particular data are the recorded statements of the Bible as the inspired book of Christians. (*d*) The exegetical results of this study are employed by *systematic* theology, which arranges them in a dogmatic system. (*e*) *Historical* theology shows how these ideas have worked during the course of the history of the Church; and finally (*f*) *practical* theology explains how the clergyman, in his varied avocations, employs them for the use of Christian people.

The determining factor in theology is, therefore, that of the being and nature of God. How God is knowable; what are the limits of religious knowledge; how God is revealed to men—these are the fundamental ideas. "First, there is in the mind a certain vague unresolved feeling and consciousness of God; second, this resolves itself and breaks up into separate individual sentiments, passing over into ideas, opinions, convictions, beliefs. This is the sphere of religion. Third, this mass of individually distinct beliefs is again bound, by passing some principle through them, into a new unity. And this is theology." (A. B. Davidson, *Biblical and Literary Essays*, p. 2.)

Theology is impossible without theism, and it varies with the particular form of theism which is adopted. The strain of theology lies in its relation to religious intuition on the one hand, and to the reflective reason on the other. The conception of God given in intuition or in emotional religious experience has to be correlated with the data of reflection; neither intuition nor reason must be undervalued. And it is repeatedly found that the adjustment is difficult. Intuitive knowledge of God, which is unreflective, often implies a view of God which is deeper than the religious person realises; it is the task of theology to bring this to consciousness.

On the other hand, the construction of theological reflection has to be kept in close touch with the living data of the religious consciousness, otherwise there is a danger of theology becoming unduly speculative. In one sense, this strain is no more than that between the two impulses in life for goodness and for truth. But it is a strain which is specially severe in theology, and a strain which cannot be evaded, except at the cost of vitality. Theology is rooted in religion. Yet it cannot dispense with a philosophy, any more than it can afford to identify itself

with any particular philosophy.—BIBLIOGRAPHY: James Drummond, *Introduction to the Study of Theology* (1884); A. M. Fairbairn, *The Place of Christ in Modern Theology* (1893); C. Gore, *Belief in God* (1920).

THEOPHRASTUS. The successor of Aristotle at the Lyceum, born 372 B.C., and died 287 B.C. He was a native of Eresus, in the Island of Lesbos. His father was a fuller by trade. He studied philosophy under Plato at the Academy, and became the intimate friend and favourite pupil of Aristotle, who gave him the name of Theophrastus on account of his graceful eloquence. His original name was Tyrtamus.

When Aristotle left Athens for Chalcis in 322 B.C., Theophrastus became Principal of the Peripatetic School, over which he presided until his death. He was a populariser of science rather than an original thinker. He added much to the fame of the Lyceum, acquired a great reputation, and was given a public funeral. Menander (q.v.) was one of his pupils.

Theophrastus took all knowledge for his province. He specialised in polymathy, which, according to Heraclitus, does not educate the mind. His lost works include: *On Animals which change their Colour, On Solecisms, On Drunkenness, On the Education of Children, A History of Geometry,* and *On Music.* His extant works consist of: *On Sensuous Perception, On Metaphysics* (a fragment), *A History of Plants, On the Causes of Plants, On Stones, On Winds, On Weather Signs,* and the *Ethical Characters.*

The botanical writings of Theophrastus are seldom read, even by professional scholars; his reputation rests almost entirely upon his *Characters.* This work consists of thirty brief and trenchant sketches of different types of men—the Boor, the Superstitious Man, the Late Learner, the Coward, and so on. It has been frequently imitated, e.g. by Hall (1608), Sir Thomas Overbury (1614), Bishop Earle (1628), and La Bruyère (1688). Theophrastus provides a curious example of how a literary reputation may survive. It is as if a Professor of Universal Knowledge at Oxford or Cambridge should be remembered mainly by his occasional contributions to *Punch.*—Cf. Sir R. C. Jebb, *The Characters of Theophrastus* (text, notes, translation, and elaborate introduction, the whole revised by Sir J. E. Sandys).

THEORY OF FUNCTIONS OF A COMPLEX VARIABLE. A complex number, sometimes called an imaginary number, has the form $a + b\sqrt{-1}$, where a and b are real numbers. Complex numbers make their first appearance as roots of quadratic equations. The square of every ordinary number, positive or negative, integral or fractional, is a positive number. Hence no negative number has a square root if the numbers at our disposal are all ordinary (or *real*) numbers. We may, however, introduce a symbol $\sqrt{-1}$, without defining its meaning, but subjecting it to the conditions that it is to be combined with itself and with real numbers by the ordinary laws of algebra, and that its square is to be -1. We thus, it is found, add immensely to the symmetry and completeness of algebra. Every quadratic equation has now two roots, equal or unequal, real or imaginary; and, more generally, every rational integral equation (q.v.) of degree n has exactly n roots. An important example is the equation $x^n = 1$. It can be shown that $(\cos 2r\pi/n + \sqrt{-1}\sin 2r\pi/n)^n = 1$, this being a special case of the very important result in trigonometry known as De Moivre's Theorem, which is that $(\cos A + i \sin A)^n = \cos nA + i \sin nA$, where i is, as usual, written for $\sqrt{-1}$. Thus we obtain n nth roots of 1, by giving r the values $0, 1, \ldots, (n-1)$ in the expression $\cos 2r\pi/n + i \sin 2r\pi/n$.

Great advantages are gained by allowing the variable or argument, on which mathematical functions depend, to assume all values whatever, real or imaginary. The foundations of the theory based on this idea were laid a hundred years ago by Cauchy. Many mathematicians have contributed to its development, notably Riemann and Weierstrass, and its bounds are still extending rapidly. Its processes are marked by extraordinary power and beauty, and with its help it is a matter of the greatest ease to solve many problems that are quite intractable by analysis restricted to real variables. BIBLIOGRAPHY: G. Chrystal, *Algebra*; T. M. Macrobert, *Functions of a Complex Variable*; A. R. Forsyth, *Theory of Functions of a Complex Variable.*

THEOSOPHY (Gr. *theos,* god; *sophia,* wisdom). A term applied to various cults and conceptions of divinity. It denotes knowledge of God obtained by direct intuition of the divine essence. It is at once related to and distinguished from both theology and philosophy, the former dealing with knowledge of God obtained by revelation, the latter with knowledge obtained by reasoning.

Max Müller (*Theosophy or Psychological Religion*) defined theosophy as "expressing the highest conception of God within the reach of the human mind, and the perception of the eternal oneness of human and divine nature." Its knowledge is intuitive and not based on facts accessible to any ordinary intelligence. Theosophy is not a modern movement, and its origin may be traced to India, which is its home. The doctrine of an immediate intuition of the divine nature is found in Brahmanism; in the Upanishads; in the Hindu philosophical schools of Vedanta, Sankhya, and Yoga; in Neo-Platonism; in Jewish-Greek Philosophy; and in the Cabbala. It was subsequently developed in the teaching of Paracelsus, of Eckhardt, Tauler, and especially of Jacob Boehme.

In modern times the term theosophy is applied to a form of belief promulgated by Mme Blavatsky (q.v.) (1831-91). She gave out that she had received her doctrines from certain masters, or mahatmas, who had reached a higher plane of existence and of spiritual development and who had communicated to her the true solution of the problems of the universe.

Modern theosophy claims to be at once a religion, a philosophy, and a science. It is a science based on the investigation of the occult laws of nature, laws grasped only by those who are qualified for inquiry, and who, in consequence of their knowledge, obtain superhuman powers. Modern theosophy studies nature, but it studies it for the purpose of discovering the mysterious Being whom nature both hides and reveals. It accepts the universal truths common to all religions, as the founders of all religions were inspired men, masters, whose teaching came from the same source, divine wisdom. Religiously, theosophy teaches the unity of God, the manifestation of God as a Trinity, and the existence of a graded order of intelligences. It proclaims the doctrine of incarnation and the law of *karma*. Ethically, theosophy is altruistic, and preaches the gospel of universal brotherhood. Philosophically, it is idealistic, and scientifically, it investigates the superphysical world, but by senses which "respond to vibrations of matter."

Man is supposed to be septuple, i.e. he is composed of seven parts, four being the physical man, and three the spiritual. According to Mrs. Besant, the two fundamental truths of modern theosophy are: (1) the transcendence and immanence of God; and (2) the solidarity and brotherhood of all human beings, i.e. "man's identity of nature with God, and man's identity of nature with all around him."

In 1875 (17th Nov.), in New York, Mme Blavatsky and Colonel Olcott formed the Theosophical Society for the following purposes: (1) to form a nucleus of a universal brotherhood of humanity without distinction of race, sex, creed, caste, or colour; (2) to encourage the study of comparative religion, science, and philosophy; (3) to investigate the unexplained laws of nature and the powers latent in man. The new movement has now spread all over Europe, and its adherents endeavour to offer to humanity a new philosophy which renders life intelligible. — BIBLIOGRAPHY: H. P. H. Blavatsky, *Secret Doctrine*; *Key to Theosophy*; A. Besant, *Popular Lectures on Theosophy*; C. W. Leadbeater, *Outline of Theosophy*.

THERAPEUTÆ. A Jewish ascetic sect, similar to the Essenes (q.v.), described by Philo Judæus in his work *De Vita Contemplativa*. The sect originated in the neighbourhood of Alexandria, especially on the shores of Lake Mareotis. Recluses, ascetics, celibates, and mystics, the Therapeutæ lived on semi-monastic lines, divested themselves of all their worldly possessions, renounced their families, and retired from the world to solitude, where they led a studious life. It was held for a long time that Philo had described Christian monks, but modern scholars are of opinion that a Jewish sect of Therapeutæ really existed.

THERAPEUTICS (from θεραπεύω, meaning, *I treat* or *heal*) would appear to comprehend the whole aim of inquiry and practice in the medical sciences. Yet, paradoxically, it is only within living memory that any considerable advance has been made towards placing the study upon a scientific footing. This becomes the more intelligible if we consider that disease is but a deviation from the normal animal physiology, more or less profound and inimical to the continuance of healthy function, and that a rational system of treatment must necessarily comprehend the means of reversing this deviation, which are rarely to be found in ignorance of its precise nature.

Massage as a therapeutic measure is not peculiar to human beings, and the conscious search for the means of alleviating suffering or of promoting health or fertility is of early origin in human society. The wearing of clothing is now held to have had its

origin in the use, by the pre-dynastic Egyptians, of cowrie shells, symbols of life-giving. The ancient Greeks collected simples, which they applied internally and externally for the relief of the symptoms of disease, and it was from lists of these that the earliest pharmacopœia was compiled. Philtres, draughts, potions, charms, and spells are interwoven into the social as well as the medical history of the Middle Ages, and the long association of medicine with learning laid an enormous mass of information, largely spurious, on the threshold of the nineteenth century.

So recently as Huxley's student days, the science of drugs was little more than a vast accumulation of inconsiderable facts which the science of chemistry was soon to drive from the armamentarium of the physician. Thus the twin sciences of therapeutics and pharmacology (*φάρμακον* = a drug) fell into a well-merited disrepute from which they are only beginning to recover. The view, cynical or sane, according to individual opinion, is still held that the drugs which are of use in the treatment of disease can be counted on the fingers, and certainly iron, arsenic, mercury, antimony, opium, digitalis, ipecacuanha, strychnine, quinine and the salicylates, a few anæsthetics, and the chief purgatives—some of these either wholly new additions to the pharmacopœia or now administered in new compounds by new methods—do not constitute a large inheritance from past centuries. These are life-saving and pain-preventing remedies in their proper uses; curative too in all but the strictest sense of the term, for it is doubtful whether every morbid condition, once established in the body, does not influence, in a manner varying from the extreme of incapacity to the extreme of inconsequence, the subsequent history of the organism.

But in recent years the attitude towards therapeutics, and particularly pharmacology, has undergone a profound change. Professor Dixon, of Cambridge,[1] who has summarised the chief causes of this change, draws attention to experimental observations, such as Magendie's on the action of strychnine; Bernard's on curare; Fraser's on strophanthus, a cardiac tonic similar in its action to digitalis; and the varied experiments with the alkaloid, quinine, isolated from cinchona bark by Pelletier and Dumas in 1820.

As factors in modern advancement he instances further the new relationships between pharmacology and physics and chemistry, in regard to the chemical structure of the molecule and the physical processes of adsorption, surface tension, and solution; the physiological discovery of the internal secretions of the body, to all intents and purposes drugs within the animal economy (adrenalin, thyroidin, pituitrin), which has opened up a wholly new chapter in biology and therapeutics alike; and lastly the enormous advances made in the study of the body tissues and fluids, and their activity in the establishment of immunity to specific infections. If we exclude surgery, itself a branch of therapeutics, attaining its ends through changes in the gross structure of the body, the older art of treatment was almost wholly empirical; the new tends more and more to be rational. This is true even while the use of some drugs, and among them not the least valuable, is still purely empirical.

The new therapeutics thus tends to be divided into subdivisions of the subject, corresponding with subdivisions of physiology. Following upon the brilliant work of Metchnikoff and Ehrlich and a host of other workers on immunity, the new science of *immunology* has already enriched medicine with a large number of diagnostic reactions—for use, for example, in typhoid (Widal); food-poisoning (Gaertner); dysentery (Shiga and Flexner); pneumonia, diphtheria (Schick); spotted-fever, cholera, syphilis (Wassermann); tuberculosis (Calmette, Von Pirquet, and Moro)—and vaccines, antitoxins, and antibacterial sera.

The name of Sir Almroth Wright is prominently associated with this development of immunology, the triumph of typhoid inoculation during the Great War serving still further to draw attention to his methods. These advances, in themselves positive, have led to others. Thus the ill-effects which have followed the injection of serum (anaphylactic shock) have paved the way to a wider knowledge of natural protoplasm poisonings to which some persons are peculiarly susceptible, e.g. asthma, and pointed the way to the cure of the resulting morbid conditions.

Again, the ductless glands of the body, the chief "regulators of metabolism" as they have been called, are better understood in their chemistry and physiology than formerly, and an extensive *organotherapy* is in consequence developing, providing us with new powers of control over disease. Examples are the use of thyroid extract in myxœdema and cretinism, both diseases of thyroid

[1] Article "Pharmacology and Therapeutics" in Sir George Newman's memorandum on *Medical Education in England*, H.M. Stationery Office, 1923.

insufficiency or deficiency; of adrenalin in the treatment of exhaustion and shock; of pituitrin in midwifery; and, still more recently, of insulin, a pancreatic extraction, in the treatment of diabetes. Mention may also be made of Dr. Serge Voronoff's experiments in the rejuvenation of the human body by the engrafting of healthy animal glands.

Under the heading of specifics comes the large number of synthetic drugs provided by the co-operation of German science, chemical and medical, and industry. "Salvarsan," dihydroxy - diamino - arsenobenzene, Ehrlich's six-hundred-and-sixth experimental anti-syphilitic drug, is but an indication of the possibilities of the modern pharmacology in relation to therapeutics. It is to be regretted that there is not yet established in this country an institute of experimental therapeutics comparable with that of Ehrlich in Frankfurt.

Electricity, X-rays, and radium are at present empirical remedies in disease; but as the outcome of modern science and research they should be mentioned; the physiology and pharmacology of anæsthetics is a rapidly advancing study; psychotherapy is the application of recent additions to our knowledge of human psychology, many of them important, to morbid mental and physical states; while in *heliotherapy* we have an example of the curative uses of man's natural environment, a complex and powerful determinant of his vital courses of which all too little is known with accuracy. — BIBLIOGRAPHY: Clark, *Applied Pharmacology*; Cushny, *Pharmacology and Therapeutics*; Osborne, *Principles of Therapeutics*; Musser and Kelley, *Practical Treatment*.

THERE'SA, ST. Spanish nun, born at Avila in 1515, took the veil among the Carmelites at the age of twenty-four. Being dissatisfied at the relaxation of discipline in the order to which she belonged, she undertook to restore the original severity of the institute. The first convent of reformed Carmelite nuns was founded at Avila in 1562, and was speedily followed by a number of others. She died in 1582, and was canonised by Pope Gregory XV. in 1621. She was the author of several works, all of a devotional nature, among them a very curious life of herself.

THEREZINA. A city of Brazil, capital of the state of Piauhy, on the Parnahyba. There is a sugar-refinery, and cotton and soap-making industries. Pop. 64,000.

THERMAL CONDUCTION. One of the three methods by which heat (q.v.) passes from one point to another. In an unequally heated body, all the points which at a given moment have a given temperature V lie on a surface, called an *isothermal* surface. The *flux* of heat at a point P, i.e. the quantity of heat which flows per unit time across unit area of the isothermal surface through P, is equal to the product of the temperature gradient at P by a constant called the *conductivity* of the material of the body; the temperature gradient being the rate of fall of temperature per unit length along the normal to the isothermal. If the conductivity is k, the heat crossing any area dS in time dt is therefore $-k(dV/dn)dSdt$, where $-dV/dn$ is the rate of fall of temperature per unit length in the direction perpendicular to dS. In a rectangular element of volume with one corner at (x, y, z) and with sides dx, dy, dz, it is easily shown (*see* POTENTIAL for the method) that the net heat acquired in time dt is $k(d^2V/dx^2 + d^2V/dy^2 + d^2V/dz^2)dxdydzdt$. If s is the specific heat per unit mass, ρ the density, and dV the rise of temperature of the element $dxdydz$ in time dt, the heat used in raising the temperature is $s(\rho dxdydz)dV$, and this is equal to the net heat taken in. Hence, dividing by $dxdydzdt$, we have

$$dV/dt = (k/s\rho)(d^2V/dx^2 + d^2V/dy^2 + d^2V/dz^2).$$

This is the equation on which Joseph Fourier based his beautiful work, the *Théorie Analytique de la Chaleur*, to the inspiration of which a great part of the mathematics of the last hundred years is directly due. One of Fourier's solutions was applied by Lord Kelvin to the determination of the age of the earth from observations of underground temperatures. His result was far below the period claimed by geologists, but the discovery of the perennial radiation of heat by radio-active bodies in the earth's substance has made Kelvin's analysis obsolete, and given the geologists more than their revenge.— Cf. H. S. Carslaw, *Fourier Series and Integrals, and the Theory of Conduction of Heat*.

THERMAL VALUE OF FUELS. When fuels are purchased, it is the possible production of heat which is paid for. It is therefore important that the thermal or calorific values should be tested, and the purchase decided from the standpoint of cheapness of heat production, other factors being equal. In actual practice the

factors which must be considered are the quantities of ash produced, and the presence or absence of constituents injurious to the continued use of the plant.

For fuel-testing, instruments known as calorimeters are available for the combustion of known amounts of the fuel and the determination of the quantity of heat produced. In those used for coal, the fuel after powdering is made into a pellet, and is ignited by contact with an incandescent platinum wire, and burned inside a glass vessel supplied with an atmosphere of oxygen and surrounded by a measured quantity of water. The heat given up in the burning of the weighed amount of coal may be measured by noting the rise in temperature of the water, and allowing for that taken up by the instrument. It is customary to assess the instrument as being equivalent to an additional amount of water, known as the water equivalent, in its heat-absorbing actions. Certain refinements are necessary if accuracy is essential, such as allowances for radiation. For very accurate work, great care is taken in measuring the heating actions with highly heat-insulated instruments, known as bomb calorimeters. In gas-testing, the rate of burning is kept uniform, and the heat is used to raise the temperature of water flowing at a constant velocity in or around tubes in the instrument. Oils may be dealt with in either the same way as coal, with the use of an absorbent pellet of known calorific value, or as a gas, with the oil burner and container suspended to the one arm of a balance to facilitate the measurement of the usage.

In every case there are two calorific values to be considered, because the hydrogen in the fuel unites with oxygen to form water. If it passes away in the form of steam, it will not give up its latent heat for useful employment, but if it is condensed to the liquid form it will do so. In consequence there are the net and the gross values to be considered, according to the conditions of the combustion.

Chemical analysis, to obtain the proportions of the carbon, hydrogen, and oxygen in the fuel, may be used as a preliminary to the calculation of the calorific value, but allowances must be made to cover the heat used in splitting up the structure of the fuel and dividing up or decomposing the chemical combinations it contains. The subject of heat values is of some interest for the general public, for their gas bills are now dealt with on the basis of the available heat contents of the combustible.

THERMIDOR (G. *therme*, heat; *doron*, gift). The eleventh month of the year in the calendar of the first French Republic. In the years I.-VII. it extended from the 19th July to 18th Aug., and in the years VIII.-XIII. from the 20th July to 19th Aug.

THERMOCHEMISTRY. A branch of physical chemistry concerned with the heat changes—evolution and absorption—which are associated with chemical processes. The main general principles of the subject are simple deductions from the law of the conservation of energy, but a good deal of experimental work on the thermal accompaniments of chemical action had been done before 1850, the date at which the consequences of Joule's epoch-making measurements may be considered to have become fully recognised.

Among early workers the most notable were Thomas Andrews (q.v.) and G. H. Hess (1840). To Hess is due the *law of constant heat sums*, according to which the total heat effect in a given chemical change is the same, no matter by what separate steps the final change is brought about. This law is still used to determine heats of formation (see below), when these cannot be found by direct experiment. Julius Thomsen and M. P. E. Berthelot stated a *principle of maximum work*, which asserts that every spontaneous chemical action is accompanied by evolution of heat, never by absorption. This principle, although applicable in the great majority of cases which occur in practice, is not universally true; it is indeed obviously inconsistent with the well-known fact that certain reactions can be reversed by slight modification of the conditions. The true criterion which determines whether a given reaction will or will not take place spontaneously, though also a principle of maximum work, is somewhat more recondite than Berthelot's law; it depends on the second law of thermodynamics (q.v.).

When two elementary substances unite so as to form a more or less stable compound, the heat evolved, which is usually expressed in calories, is called the *heat of formation*. We meet with such equations as

$$C + 2O = CO_2 + 94{,}300 \text{ cals.},$$
$$\text{and } CO + O = CO_2 + 68{,}000 \text{ cals.}$$

The first equation means that 12 grammes of carbon (the atomic weight of carbon being 12) unite with 32 grammes of oxygen to produce 44 grammes of carbon dioxide, with the evolution of 94,300 calories of heat; or, in other words, that carbon and

oxygen, in uniting to form 44 grammes of CO_2, lose intrinsic energy of amount 94,300 calories. By subtraction, we find from the two equations the loss of intrinsic energy in passing from C + 2O to CO + O; that is to say, the heat of formation of CO is 94,300 − 68,000, or 26,300 calories. Most substances have *positive* heats of formation, and these are called *exothermic*; but some substances, called *endothermic*, give out heat when they are decomposed, so that their heats of formation are negative. Endothermic substances, among which are acetylene, hydriodic acid, nitrous and nitric oxides, and nitrogen trichloride, are unstable to a greater or less degree, some of them being liable to break up into their elements with a violent explosion.

The *heat of combustion* of an organic substance is the amount of heat evolved when the carbon and hydrogen of the substance are oxidised completely to carbon dioxide and water, under defined conditions. From the heat of combustion of a substance its heat of formation can be deduced indirectly. Methane, for example, an important constituent of gaseous fuels, burns in accordance with the equation

$$CH_4 + 4O = CO_2 + 2H_2O + 213{,}800.$$

But the heat of formation of CO_2 is 94,300 calories and that of liquid water is 68,300 calories. Hence the production of $CO_2 + 2H_2O$ should be accompanied by the evolution of 94,300 + 136,600, or 230,900 calories, The deficit 230,900 − 213,800, or 17,100 calories represents the heat already used up as the heat of formation of CH_4 from its elements.

Other sections of thermochemistry deal with *heat of solution*, the heat developed when a substance combines with water to form a hydrate; and *heat of neutralisation*, the heat given out when an acid combines with a base to produce a salt. When a powerful monobasic acid, such as HNO_3 or HCl, unites with a strong monacid base, like NaHO or KHO, the heat developed is in all cases approximately the same, viz. about 137,000 calories.

THERMODYNAMIC ENGINE. Any type of engine in which the heat energy contained in the working substance is partly converted into mechanical energy. Steam, gas, or the other substances employed are in popular use, because of the convenience of the utilisation of the heat they contain. The efficiency of an engine is the ratio of the heat converted into work to that taken into the engine. Only a limited proportion of the heat contained in the working substance can be utilised, as the operations are governed by the two temperatures of heat reception and rejection.

The limit of possible efficiency is given as the ratio of the difference of temperature between inlet and exhaust to the absolute temperature of inlet. That value can only be attained when all the heat is received at the high temperature, and all the heat rejected is sent away at the low temperature and the cycle of operations is reversible. It is attainable in Carnot's and certain other cycles, but is not obtained from a steam-engine with a separate boiler and condenser, or indeed with any practical engine. For purposes of comparison, the Rankine or Clausius cycle is used as a basis for steam-engines. In it the normal compression bringing back the working substance to its entrance conditions is eliminated, and exhaust continued until the end of the stroke. It is a cycle of possible practical achievement, and is therefore a more suitable standard for an actual steam-engine.

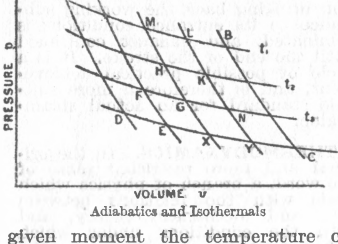
THERMODYNAMICS. In the original and more restricted sense of the word, a branch of physics which deals with the relations between heat and mechanical energy, and with the conditions under which either may be converted into the other. The science is based on two empirical laws, called the *first* and *second laws of thermodynamics*, and its main conclusions are deduced from these laws by a process of pure reasoning, without further appeal to experiment. Since these laws apply to the relations of heat to other forms of energy (e.g. electrical or chemical energy) besides mechanical energy, or work, the word thermodynamics has in modern practice come to be used in an extended sense as including the whole body of physical and chemical doctrine resting upon either or both of the two laws.

The *first law* is simply the principle of the conservation of energy (*see* ENERGY, PHYSICAL). The *second law* has been stated in various forms. As put by Clausius it runs: It is impossible for a self-acting machine unaided by any external agency to convey heat from one body to another at a higher temperature. Both laws are of the negative type; the first denies the possibility of creating or destroying energy, the second the possibility of transforming heat into work in a particular way. It has been said that the laws deny the possibility of *per-*

petual motion of the *first* and of the *second* kinds.

The science was founded by Sadi Carnot, who, in his *Étude sur la puissance motrice de la chaleur*, was the first to make a positive deduction from the negation involved in the second law. Carnot introduced the important idea of a *cycle*, i.e. a series of changes in which the initial and final states of the body or system considered are identical.

Carnot's Cycle. Take unit mass of any fluid, which may be a liquid in contact with its saturated vapour, but which for simplicity we shall suppose to be a gas. We are to subject this fluid to certain changes of volume, pressure, and temperature, so that it may be called the *working substance*. The changes are supposed to take place so slowly that at any



Adiabatics and Isothermals

given moment the temperature of the body may be regarded as the same throughout. In these circumstances the state of the body is completely defined if we know any two of the three variables, its pressure, volume, and temperature. We shall suppose that the pressure and volume are the two independent variables chosen. Any state of the body is then represented by a point on the p, v diagram (see figure). Let the body be taken through a cycle specified by the path ABCD. From A to B the body is supposed to expand at constant temperature or *isothermally*; from B to C no heat is allowed to enter or leave, in which case the expansion is said to be *adiabatic*; from C to D the body is compressed at a constant temperature, which is lower than the original temperature; and from D to A the body is compressed adiabatically. The series of changes thus defined constitutes the *Carnot cycle*. The final state of the body is exactly what it was originally; what has happened is that a certain quantity of heat Q_1 has been taken in at the higher temperature T_1, another quantity of heat Q_2 has been given out at the lower temperature T_2, and a certain amount of external work has been done, represented, as can easily be proved, by the area ABCD. By the first law, the quantity of heat $Q_1 - Q_2$ which has gone out of existence is mechanically equivalent to the work done by the working substance.

A very notable feature of Carnot's cycle is that it is a *reversible* one. The whole process could be carried out backwards, the working substance being at any particular stage in the same state as at the corresponding stage in the original process. This reversibility is essentially due to the fact that at every point of the cycle the body is in a state of equilibrium, that is, a state in which it would remain permanently, did we not start a change, by just increasing the pressure for instance, or just lowering the temperature.

Carnot's great contribution to thermodynamical theory was his proof that no engine working between a given upper and lower temperature can be more efficient (that is to say, can produce more work for a given intake of heat) than a *reversible* engine working between the same temperatures, and hence that the efficiencies of all reversible engines working between stated limits are the same. Carnot proved this by showing that if it were not so, we could imagine a combined arrangement in which the given reversible engine would be driven backwards by the other, so that in every cycle a certain net amount of heat would be taken in at the lower temperature, and rejected at the upper, without any energy being supplied from outside. This conclusion is directly contrary to the second law. Hence, in all reversible engines working on the Carnot cycle between given temperatures, whatever the working substance and the design may be, the ratio of the work done to the heat taken in is the same. But since the work done is equivalent to the difference between the heat taken in and the heat rejected, it follows that the ratio only of heat taken in to heat given out depends only on the two temperatures.

Further, it can be shown that this ratio has the form of the ratio of a function of the one temperature to the same function of the other. To prove this, consider the part of the figure between the isothermals, t_1, t_3, and the adiabatics MHG, LKN. Let the quantities of heat taken in along ML, HK, GN be Q_1, Q_2, Q_3 respectively. Then, as has just been shown, Q_1/Q_3 depends only on the temperatures t_1, t_3; and Q_2/Q_3 only on t_2, t_3. By division, it follows that Q_1/Q_2 is the ratio of a

function of t_1, t_3 to a function of t_2, t_3; and t_3 must divide out, since Q_1/Q_2 is independent of t_3; hence Q_1/Q_2 is the ratio of a function of t_1 alone, to a function of t_2 alone.

This very important result led Lord Kelvin to the definition of an *absolute temperature* scale. It is to be observed that although we are able to give exact definitions of many special temperatures, such as the temperature at which pure water boils at a stated pressure, there is nevertheless an element of arbitrariness about the *numbers* which we shall attach to these temperatures. It so happens (*see* HEAT; THERMOMETER) that the laws of expansion of liquids and gases under increase of temperature, at constant pressure, or, more generally, the laws connecting the pressure, volume, and temperature of a given mass of gas, are approximately so simple and uniform that liquid and gas thermometers of many different types give closely accordant results.

On Kelvin's scale, however, the results are absolutely identical, no matter what the working substance may be. His definition is that the numerical values of temperatures are to be so assigned that, in the notation used at the end of the preceding paragraph, $Q_1/Q_2 = T_1/T_2$. To make this definition perfectly precise, it is added that the difference of the numbers representing the ordinary fixed points of the mercury thermometer is to be 100. Kelvin showed, partly by mathematical analysis and partly by experiments carried out in conjunction with Joule, that the absolute scale differs very little from the scale of the constant-volume hydrogen thermometer. Experiments on actual substances show, indirectly, that when T_1 and T_2 are the boiling- and freezing-points of water, then Q_1/Q_2 has the value 373·1/273·1. These numbers differ by 100, so that the freezing-point of water on the absolute (centigrade) scale is 273·1; or, if we change the origin to the freezing-point of water without changing the numbers for intervals of temperature, then the absolute zero is −273·1° C. Since $(Q_1 - Q_2)/Q_1 = (T_1 - T_2)/T_1$, and $Q_1 - Q_2 = W$, the work done by the reversible engine, it follows that the efficiency of the engine is $(T_1 - T_2)/T_1$. If $T_2 = 0$, this fraction is 1, so that all the heat taken in from the source is converted into work, if the condenser is at absolute zero.

The existence of the function of the state of the body called the *entropy* (*see* ENTROPY; STEAM-ENGINES) can now be proved. Let a body, the states of which are represented in a p, v diagram, intersected by isothermal and adiabatic lines (see figure) pass reversibly from the state D to the state B along any path made up of parts of isothermals and adiabatics, e.g. the path DEFGHKLB. Let the quantities of heat taken in along the isothermal intervals DE, FG, HK, and LB be q_4, q_3, q_2, q_1 respectively, the corresponding absolute temperatures being t_4, t_3, t_2, t_1. Then we can determine the heat taken in if the body is made to pass from the state D to the state B along the path DXYCB. For heat along EX/heat along FG $= t_4/t_3$ so that heat along EX $= q_3t_4/t_3$. Similarly along XY and YC, the heat taken in is q_2t_4/t_2 and q_1t_4/t_1. Let us now take D to be a standard state, and *define* the *entropy* at B as the fraction (heat taken in along DC)/t_4, a perfectly definite quantity when the states D and B are given. Then what we have *proved* is that the entropy of B $= q_4/t_4 + q_3/t_3 + q_2/t_2 + q_1/t_1$. Similarly, entropy at F $= q_4/t_4$, so that entropy at B − entropy at F $= q_3/t_3 + q_2/t_2 + q_1/t_1$. In words, if a body pass from one state to another by a path made up of parts of isothermals and adiabatics, then the increase of its entropy is the sum of the fractions (heat taken in)/(absolute temperature), taken for all the isothermals.

It is easy to deduce a corresponding result for the case when the passage from one state to another (say F to B) is effected by any reversible path whatever. In this case, entropy at B − entropy at F $= \int dq/t$, the integral being taken along the given reversible path, where q is the net quantity of heat taken in from the initial point F up to the point where the temperature is t; and dq is the differential of q. The existence of a function of state, the entropy ϕ, with the property $d\phi = dq/t$, is for a single body the exact equivalent of the second law; just as the existence of the energy E is equivalent to the first law. All the properties of a single body which can be proved by thermodynamics are deducible by pure mathematics from the existence of the energy and the entropy.

Closely related to entropy are the ideas of *availability* and *dissipation* of energy. A quantity of heat q has the energy value q, whatever may be the absolute temperature t of the body from which this heat is taken. But only a fraction of this value q is available for conversion into work, or *mechanical* energy. In fact, if t_0 is the temperature of the coldest body which can be used as condenser, then qt_0/t units of heat are given out at t_0, and are of no further use for the production of work; they are said to have

been *dissipated*. The remainder, viz. $(1 - t_s/t)q$ units, is the quantity originally *available*. In the ordinary processes of nature, frictional effects, and the exchanges of energy between the parts of a system which is not in equilibrium, are powerful agents continually at work in the dissipation of energy. These latter effects increase the entropy of a system—if we define this to be the sum of the entropies of its parts—without altering the energy. When, for example, q units of heat pass by radiation from a body at temperature t to another body at t_s, the entropy of the first body diminishes by q/t, while that of the second increases by q/t_s; and, since t_s is less than t, the total entropy is increased.

The tendency for the entropy of an isolated system to increase led Boltzmann to speculate on the relationship between the entropy and the *probability* of a given state of the system. Without attempting any precise definition, we may see in a general way that there is some sort of connection between the two, since both tend to a maximum as the system tends to its final state of stable equilibrium; and since entropies are additive, and probabilities are combined by multiplication, the entropy may be expected to be proportional to the *logarithm* of the probability.

The earliest applications of thermodynamics had reference to the more purely physical properties of bodies, and to the theory of heat engines. Important applications were afterwards made by Helmholtz, Williard-Gibbs, and others to physical chemistry. Helmholtz introduced the idea of *free energy*, which is found more convenient by the chemist than that of *entropy*. When a physico-chemical system passes from one state of equilibrium to another, a certain amount of energy is either disengaged or has to be supplied, the amount varying with the circumstances under which the change takes place. If the change is made *reversibly*, then the mechanical energy obtainable from the change has its greatest possible value, this being a consequence of the second law. This maximum amount of disengaged mechanical energy is what Helmholtz calls the free energy of the given reaction or change. Thermodynamical methods occupy a prominent place in modern discussions of such subjects as the equilibrium of homogeneous systems and the theory of valency.

BIBLIOGRAPHY: W. Inchley, *Theory of Heat Engines*; Sir J. A. Ewing, *Thermodynamics for Engineers*; J. R. Partington, *Text-book of Thermodynamics: with special reference to Chemistry*; W. C. M'C. Lewis, *A System of Physical Chemistry*, vol. ii.; W. H. Macaulay, *Laws of Thermodynamics*; F. F. P. Bisacre, *Applied Calculus*; *Modern Mechanical Engineering*, vol. iv. (The Gresham Publishing Company).

THERMOELECTRICITY. That branch of electricity which deals with currents produced by heat from two dissimilar metals. Seebeck discovered (1821) that when one junction of two metals, such as copper and iron, is heated while the other junction is kept cool, an electric current flows round the circuit, passing from copper to iron through the hot junction. The current increases with the difference of temperature of the junctions. If the junction is made colder than the rest of the circuit, the current will flow in the opposite direction. Metals may be arranged in such order that each is thermoelectrically positive to the following metal. If one of the metals is lead, the electromotive force of the pair per degree C. is called the thermoelectric power of the second metal. This is a small number, which is usually expressed in microvolts per degree C. Thus bismuth has a thermoelectric power of about 93, and antimony of about −24; if the junction bismuth-antimony is used, its power is 93 + 24, or about 117 microvolts per degree C.

Thermoelectric Inversion. Cumming discovered that the thermoelectric property of a pair of metals may be inverted at high temperatures. To illustrate this, let one junction of a copper-iron pair be steadily raised in temperature while the other is kept at 0° C. The E.M.F. of the pair will increase to a maximum at 275°, and will become zero at 550° C. If the junction is raised above 550°, the E.M.F. and current will be reversed or inverted. In general, there is no current if the average temperature of the two copper-iron junctions is 275° C. This is called the *neutral temperature* of the couple; that of zinc-iron is about 200° C.

Thermoelectric Diagram. If the thermoelectric powers of different metals are plotted against the temperatures, a thermoelectric diagram is obtained which gives the neutral temperature of any pair; the E.M.F.s for different ranges of temperature are represented by areas on the diagram.

Peltier Effect. Peltier found (1834) that when a current from a battery is passed through a junction of two unlike metals, the junction is heated or cooled according to the direction of the current. Thus, when the current flows from bismuth to antimony, the junction is cooled and heat is absorbed.

The quantity of heat energy, expressed in ergs, which is absorbed when one coulomb flows through the junction is called the Peltier coefficient (P), and the total energy absorbed by i amperes in t seconds is Pit ergs.

Thomson Effect. Thomson discovered (1846) that when a current flows along a wire heated at one place, say, by a flame, there is absorption of heat on the one side and liberation of heat on the other side, the effect being as if the current carried heat with it.

E.M.F. of a Thermocouple. Let the two junctions of a couple with thermoelectric power p at 0° and neutral temperature N° be at temperatures T° and t°. Then the relation between the E.M.F. E and the temperatures has been shown by Tait to be $E = p(T - t)\{1 - \frac{1}{2}(T + t)/N\}$. With some pairs the simpler formula $\log E = A \log(T - t) + B$ has been found to hold; A and B are constants to be determined for the given pair of metals.

Thermopile. By placing a number of pairs in series, with one set of junctions exposed to heat and the other set kept cool, the E.M.F. at disposal may be greatly increased. Such an arrangement is called a thermopile; it was invented by Nobili, and was employed in conjunction with a galvanometer by Melloni as a detector and measurer of radiant heat. Thermoelectric batteries were once used for the direct conversion of heat into electric energy. The most successful of these was Clamond's; the elements were tin and an alloy containing two parts of antimony and one of zinc. The heating was done by coal-gas, and a battery of sixty pairs gave an E.M.F. of 3 volts, with an internal resistance of $1\frac{1}{2}$ ohms. The gas consumption was 3 cubic feet per hour.

The thermojunction has been employed by Boys in the radiomicrometer as a delicate detector of radiant heat, by Rubens in the linear thermopile for examination of heat spectra, and by Duddell in the thermogalvanometer for measuring small oscillatory currents such as are used in telephony. The most important practical use of the thermocouple is its application to the measurement of temperature. *See* PYROMETER.

THERMOMETER. An instrument for measuring temperature. Methods of measuring temperature are based on the different effects of heat. In one method, use is made of the expansion of a liquid within a glass vessel; in another, the expansion of a gas is employed; in a third, the gas is kept at constant volume, and the change of temperature is found from the change of pressure of the gas; in a fourth method, advantage is taken of the change of electrical resistance of a metal with change of temperature, or of the thermoelectric properties of metals; and in a fifth, the temperature is measured by means of the radiation emitted by the hot body. Of these methods the first, exemplified by the mercury thermometer, is the most convenient and compact for ordinary uses; the second and third give us, in the gas thermometers, our standard methods of measuring temperature; whilst the fourth and fifth methods, typified by the platinum resistance thermometer, the thermoelectric couple and the radiation pyrometer, constitute the only means of measuring very high temperatures. *See* PYROMETER.

Mercury Thermometer. To make a mercury thermometer, a glass bulb is welded to a capillary glass tube of uniform bore. The bulb is then heated, and on dipping the end of the tube under mercury, the cooling of the tube causes a little mercury to be drawn into the bulb. On boiling this mercury, all the air is driven out, and on again dipping the end of the tube under mercury, the metal fills the bulb and stem. Some mercury is then driven off, and the tube is sealed. On placing the thermometer in melting ice, and afterwards in the steam of water boiling at 76 cm. pressure, the temperatures 0° C. and 100° C., or 32° F. and 212° F., are marked, and the stem between the marks is then divided into 100 equal parts in the case of the centigrade thermometer, or into 180 equal parts for the Fahrenheit scale. A Réaumur thermometer is similarly dealt with, and the interval between the fixed points divided into 80 equal parts. By comparing these scales, we may find that the temperature F. corresponding to a given temperature C. or R. is given by $F - 32 = 9C/5 = 9R/4$, an equation which enables us to convert from one scale to either of the others.

The mercury thermometer has a fairly wide range; the boiling-point of mercury is about 357° C., but by using hard glass, and filling the space above the mercury with nitrogen or carbon dioxide at about 20 atmospheres pressure, the range of the thermometer has been extended to 550° C. Fused silica is now used in making high-temperature mercury thermometers. Since mercury freezes at −39° C., and atmospheric temperatures of −80° C. have been recorded, other liquids are used for low-temperature measurement.

Alcohol Thermometer. Alcohol has

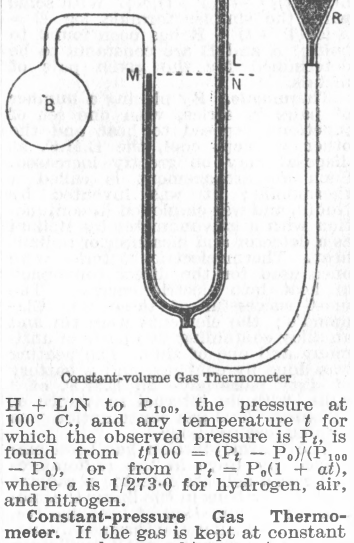
a low freezing-point (−112° C.) and a coefficient of expansion about six times that of mercury, and it is used in certain forms of thermometer for measuring low temperatures. *Pentane* has been employed in thermometers reading to −190° C.

Maximum and Minimum Thermometers. These are instruments for registering the highest and lowest temperatures which occur during the day and night. In one form, that of Six, the tube contains alcohol separated into two portions by a column of mercury which occupies a bend in the tube. At one end of the tube the alcohol occupies a large bulb, and at the other end a smaller bulb is incompletely filled with the alcohol. Two small iron wires rest on the mercury surfaces. With rise of temperature, expansion takes place towards the smaller bulb, and one index is pushed up the tube by the mercury. If cooling takes place, the index is left behind, and its lower end records the highest temperature reached; it may be replaced by using a small horse-shoe magnet. The minimum temperature is recorded in a similar manner by the displacement of the other index. In Negretti and Zambra's maximum thermometer there is a constriction of the bore above the bulb, and after expansion has taken place, the column of mercury is left behind, and the maximum temperature is read from the top of the column.

Clinical Thermometer. A small Fahrenheit thermometer with a range from 95° to 110° is used by medical practitioners and others to find the temperature of the human body. It is a maximum thermometer on the same principle as the previous one.

Gas Thermometers. As the result of experiments designed to test the suitability of various substances for thermometric purposes, Dulong and Petit concluded that the change of volume of the permanent gases was proportional to the heat absorbed, but that this was not the case with solids and liquids. In addition, gases have a high coefficient of expansion and low thermal capacity, and they maintain the same physical properties through a wide range of temperature. For these reasons *hydrogen* is chosen as the standard thermometric substance, and changes of temperature are *defined* as being proportional to the corresponding changes of pressure which take place in a mass of hydrogen kept at constant volume.

Constant-volume Gas Thermometer. The bulb B (see figure) is filled with dry gas and immersed in melting ice, the mercury being adjusted to a mark M by means of the reservoir R. The level of the mercury L in the open manometer tube is noted, as also the barometric height H. The bulb is then immersed in steam from water boiling at normal pressure; the mercury is again adjusted to the mark M, and the new level L′ of the mercury is noted. The height LL′ gives the change of pressure for 100° C., and the degree is defined as that change of temperature which causes 1/100th of the change of pressure which results when the gas is heated at constant volume from the melting-point of ice to the boiling-point of water. The height H + LN is proportional to P_0, the pressure of the gas at 0° C., and



Constant-volume Gas Thermometer

H + L′N to P_{100}, the pressure at 100° C., and any temperature t for which the observed pressure is P_t, is found from $t/100 = (P_t - P_0)/(P_{100} - P_0)$, or from $P_t = P_0(1 + \alpha t)$, where α is 1/273·0 for hydrogen, air, and nitrogen.

Constant-pressure Gas Thermometer. If the gas is kept at constant pressure, changes of temperature may be determined from the changes of volume of the gas by using the corresponding law of expansion: $V_t = V_0(1 + \alpha t)$. A simple form of air thermometer may be constructed by enclosing air in a long uniform tube, closed at one end, by means of a globule of mercury. An air thermometer of this kind was used by Galileo. A more complicated form is in use for standard purposes.

The gas thermometer is not adapted for ordinary use; besides, at very low temperatures difficulties appear, as the gases then approach their

critical temperatures and deviate from Boyle's law. For such cases, the electrical methods of measuring temperatures are superior. At high temperatures the bulb gives trouble; bulbs made of hard glass may be used up to 500° C.; porcelain bulbs are unsatisfactory beyond 1100° C., and platinum or platinum-iridium bulbs filled with nitrogen are used instead, since hydrogen passes through the metal at high temperatures.

THERMONATRITE. *See* TRONA.

THERMOPYLÆ. A narrow defile in Northern Greece, leading from Thessaly southward, between Mount Oeta and the sea (the Maliac Gulf, now the Gulf of Lamia), 25 miles north of Delphi, celebrated for its defence by 300 Spartans, together with allies, under Leonidas, against the Persian host under Xerxes, in 480 B.C.

THERMOSTAT. A contrivance for keeping an enclosure at a constant temperature. Many different designs are in use, the simplest and commonest depending on the expansion of a liquid or gas with rise of temperature. In one arrangement, when the temperature reaches a certain point, the liquid (e.g. toluene) closes an orifice by which the gas supply must enter. When the temperature falls again, the liquid recedes and the flow of gas recommences. A by-pass prevents the gas from ever being completely extinguished.

THEROMORPHA, or **ANOMODONTIA.** An important order of extinct reptiles, characteristic of Permian and Triassic times. In the wide range of their types of teeth, and in some features of the skeleton, they foreshadow the structure of the mammals. The small form Tritylodon from the Trias of Southern Africa, with multituberculate molar teeth, was at first described by Owen as a mammal.

THESEUS (thē'sūs). A mythical king of Athens and famous national hero of antiquity. He was the unacknowledged son of Ægeus by Æthra, the daughter of Pittheus of Troezen, in Peloponnesus. Brought up by his mother, he came afterwards to Athens, where he was acknowledged by his father as son and successor. Many notable deeds are related of him, as the slaying of the Minotaur and the freeing of Athens from the tribute of seven youths and seven maidens annually sent to Crete to be devoured by that monster. As King of Athens he is reputed to have governed with mildness, instituted new laws, and made the government more democratic.—Cf. J. E. Harrison, *Mythology and Monuments of Ancient Athens.*

THESPIS. A native of a village near Athens, who lived in the sixth century B.C., reputed to be the inventor of tragedy and of the masks which the Greek actors always wore in performing. His first representation took place about 535 B.C.

THESSALONIANS, THE EPISTLES TO THE. Thessalonica, the modern Salonika, had been evangelised by St. Paul and two colleagues during his first mission to Europe. The work at Thessalonica had been short and successful, but stormy. Jewish opposition drove Paul reluctantly away. He desired to keep in touch with the local Church in its inexperience and difficulties, and therefore wrote from Corinth the "First Epistle." Timotheus, who had been able to remain longer at Thessalonica, had brought him news of the Church, which was being not only persecuted but exposed to insidious slanders against Paul's character. He writes (*a*) to hearten the local Christians in view of their troubles, and (*b*) to repudiate the insinuations against himself. A third (*c*) object is to calm their minds about death. Some of their number had died in the interval, and Paul explains that this does not exclude them from their share in the glory of the Second Advent. He also warns the survivors against restlessness and excitement, caused by their very hope in the near approach of the Second Advent. The first two topics are interwoven in i. 2 to iii. 13. The third is inserted (iv. 13 to v. 11) in a general instruction upon the moral responsibilities of Christians (iv. 1 to v. 28).

Shortly afterwards the apostle found himself obliged to send a second epistle to correct some further misapprehensions about the Second Advent. The Thessalonian Church was not disturbed by any doctrinal controversies over the Law. The danger lay in an unregulated hope of the Second Advent, which was producing a morbid condition in many of the members.

The main object of the "Second Epistle" is to warn the Church that the Second Advent cannot take place until a certain lawless force breaks loose; then matters will come to a head, in the providence of God. But till then the Church is to attend to its duties quietly. The problem of the "Second Epistle" lies in the statement (ii. 3-12) about this lawless force, and the restraint at present holding it in. Probably the apostle anticipates a false Messianic movement within Judaism, which will challenge Jesus Christ, and the "restraining" power is the Roman Empire; so long as that Empire

lasts, with its protection of Christians against Jewish malevolence, the supernatural apostasy could not make headway, but, once it is removed, the final clash will come. The apostle therefore anticipates darkness before the dawn. But he is sure of the final victory of Christ, and bids the local Christians be patient and steadfast meanwhile.

Both epistles are written in the name of Paul, Silvanus, and Timotheus—the three original founders of the Thessalonian Church (Acts, xvii. 1-9, 15; xviii. 5)—but Paul is the real author. Suspicions of the authenticity of the "Second Epistle" were once current, but are now almost entirely abandoned. The only literary problem is whether the second was not written before the first; but the internal evidence is against this. The similarities and differences between the two epistles may be fairly explained on the hypothesis that Paul wrote them in their present order, in rapid succession, as practical religious problems emerged in the local Church.

If not the earliest, they are among the earliest extant epistles of the apostle. The only one which may have been written earlier is Galatians.

BIBLIOGRAPHY: *International Critical Commentary* by J. E. Frame (1912); *Meyer's Commentary* (1909); J. Moffat in *Expositor's Gr. Test.*, 1910. The espistles are discussed in biographies of St. Paul.

THES'SALY. A north-eastern division of Greece, mainly consisting of a rich plain enclosed between mountains and belonging almost entirely to the basin of the Peneus or Peneios (Salambria), which traverses it from west to east, and falls into the Ægean through the vale of Tempe. Thessaly and Macedonia lead Greece in cereal production. Minerals, especially chrome ore, are exported by Volo (q.v.), the chief port. Live-stock is raised. Larissa and Trikkala (where lignite is found) are other important towns. Area, 5142 sq. miles; pop. 493,213.

Thessaly was conquered (352 B.C.) by Philip of Macedon. Macedonia was annexed to and was finally incorporated with the Roman Empire. After the fall of the Byzantine Empire it came into the hands of the Turks, but the greater portion of it was incorporated (1881) with the Kingdom of Greece.

THETFORD. A municipal borough of Norfolk, England, on the Ouse. It is 28½ miles from Norwich, and 79¼ from London. The manufacture of agricultural implements, brewing, and tanning are the chief employments. In Anglo-Saxon times it was the capital of East Anglia, and had a bishop whose see was transferred to Norwich. To-day the Bishop of Thetford is a suffragan of the Bishop of Norwich. Pop. (1931), 4097.

THETFORD MINES. An industrial town of Quebec, Canada, in Megantic county; served by the C.P.R. It has asbestos-mines (near by), foundries, and many other industries. Pop. 8000.

THETIS. A Greek divinity, a daughter of Nereus and Doris, therefore one of the Nereids. By Peleus, to whom she was married, she became the mother of Achilles. Her nuptials with Peleus were celebrated on Mount Pelion, and were honoured by the presence of all the gods except Eris or Discord, who was not invited, and who, to avenge the slight, threw in among them the apple of discord. She is represented in Homer as living with her father in the depths of the sea.

THEYDON BOIS. Village of Essex. It is 15 miles from London, on the L.N.E. Rly. The church is modern. Here are **Theydon Garnon** and **Theydon Mount**, both with churches of interest.

THIAKI. Modern name of Ithaca (q.v.).

THIAN-SHAN (tē'an-), or **CELESTIAL MOUNTAINS** (properly **TIEN SHAN**). A range of Central Asia, extending from the Pamir Plateau into the Desert of Gobi. Its length is estimated at 1500 miles, and many of its summits rise to 16,000 or 17,000 feet.

THIELT. A town and railway junction of Belgium, in the province of West Flanders. Manufactures include linens, cottons, woollens, lace, and liquor. Pop. 11,611.

THIEPVAL. A village of France, in the department of Somme. It was entirely destroyed during the European War. A stone tower (a replica of the celebrated Helen's Tower, Clandeboye, County Down, the subject of poems by Tennyson and Browning) commemorates the attack of the 36th (Ulster Division) on 1st July, 1916. *See* EUROPEAN WAR.

THIERRY (ti-er-ri), **Jacques Nicolas Augustin.** French historian, born 1795, died 1856. He was for some time secretary to Saint-Simon, whose socialistic views he embraced, but he did not fail to perceive the theoretical vagaries of his master, from whom he separated in 1817. His great work *Histoire de la conquête de l'Angleterre, par les Normands*, published in 1825, attained great success both in France and in England, and although he

became blind (1826), his *Lettres sur l'histoire de France* appeared in 1827.

In 1834 he published *Dix ans d'études historiques*, a series of admirable essays, and about the same time he was summoned to Paris by Guizot, then Minister of Public Instruction, and entrusted with the editing of the *Recueil des monuments inédits de l'histoire du tiers état*, for the collection of documents relative to the history of France. In 1840 he published *Récits des Temps mérovingiens*

THIERS (ti-ăr), **Louis Adolphe.** French statesman and historian, born at Marseilles 1797, died 1877. He studied law, and at the age of twenty-two was admitted advocate. He soon relinquished law, however, for literature and politics (1821). Going to Paris, he began to write for the *Constitutionnel* and other journals, and during the years 1823 to 1830 made a great reputation as a political writer. He was at the same time engaged on his *Histoire de la Révolution française*.

Taking part with Armand Carrel and Mignet in the foundation of the *National* (1830), he subsequently assisted in editing it, strongly advocating constitutional liberty in its columns. During the July Revolution of 1830 the office of the *National* was the headquarters of the revolutionary party, and in the government of Louis Philippe Thiers held several offices, till in 1840 he found himself at the head of the ministry for a few months, and then retired into private life. After the Revolution of 1848 he was elected Deputy to the Assembly, and voted for the presidency of Louis Napoleon, but was ever after one of his fiercest opponents; and at the *Coup d'État* (2nd Dec., 1851) he was arrested and banished.

Returning to France in the following year, he remained in comparative retirement till 1863, when he was elected one of the Deputies for Paris. During the terrible crisis of 1870-1 he came to the front as the one supreme man in France. After the fall of Paris he was returned to the National Assembly, and on 17th Feb., 1871, he was declared chief of the executive power. The first duty imposed upon him as such was to assist in drawing up the treaty of peace, whereby France lost Alsace and Lorraine and agreed to pay an enormous indemnity; his second was to suppress the Communist insurrection, which broke out within three weeks of the signing of the treaty. This done, his next task was to free the soil as quickly as possible from the invaders by the payment of the ransom, which also was effected in an incredibly short space of time.

The Assembly in Aug., 1871, prolonged his tenure of office and changed his title to that of President. In Nov., 1872, Thiers declared himself in favour of the republic as a definitive form of government for France, and thus to some extent brought about the crisis which resulted in his being deprived of the presidency. He accepted his deposition with dignity, and went quietly into retirement. His chief works are *Histoire de la Révolution française* (6 vols., 1823-7) and *Histoire du Consulat et de l'Empire* (20 vols., 1845-62).—BIBLIOGRAPHY: François Le Goff, *The Life of Louis Adolphe Thiers*; J. F. Simon, *Adolphe Thiers*; P. de Rémusat, *Thiers*.

THIERS (ti-ăr). A town of France, in the department of Puy-de-Dôme, on a hill washed by the Durolle; served by the Lyons Railway. It has manufactures of cutlery and ironmongery, paper, candles, leather, etc., water being the source of power. Pop. 16,383.

THIO-ALCOHOLS, THIO-ETHERS. A group of sulphur compounds analogous to the monohydric alcohols and to the ethers. *Mercaptan*, $C_2H_5{\cdot}HS$, which corresponds to ethyl alcohol, $C_2H_5{\cdot}HO$, behaves as a weak acid and forms salts called *mercaptides*, especially mercury compounds, whence its name *corpus mercurio aptum*. The thio-ethers or alkyl sulphides, e.g. ethyl sulphide, $(C_2H_5)_2S$, are liquids of an unpleasant, piercing, leek-like odour.

THIONVILLE (ti-oṇ-vēl; Ger. *Diedenhofen*). A town and railway junction of France, in the department of Moselle (q.v.), on the Moselle. Taken by the Prussians on 25th Nov., 1870, it remained in their hands until 1918. Pop. 15,000.

THIRD DEGREE. Originally an American slang expression (probably connected with the "Third Degree" in Masonry), it has now come into general use to denote the employment by the police of violence or other forms of physical maltreatment of a prisoner in order to extort a confession.

THIRLMERE. A lake of Cumberland, England, the main reservoir of the water-supply of Manchester, to which it is carried by an aqueduct, 106 miles long.

THIRLWALL, Connop. English bishop and historian, born 1797, died 1875. Educated at the Charterhouse and at Trinity College, Cambridge, he passed from a brilliant university career to the law, but entered the Church and was ordained in 1828. His first important work was a trans-

lation of Schleiermacher's *Gospel of St. Luke* (1825), which was followed by a *History of Greece*, the first edition appearing in Lardner's *Cabinet Cyclopedia*, between 1835 and 1840. Before the appearance of Grote's history it was without a rival in the English language.

In 1840 Thirlwall was presented by Lord Melbourne to the see of St. David's, which he held till within little more than a year of his death. In conjunction with Archdeacon Hare, Thirlwall published a translation of the second version of the first two volumes of Niebuhr's *Roman History*. He was a member of the committee for the revision of the Old Testament.

THIRSK. A market town of England, in the North Riding of Yorkshire, 23½ miles N.W. of York, consisting of old and new towns, separated by the river Cod Beek. Manufactures include agricultural implements, flour, and leather. Pop. 2755.

THIRTY YEARS' WAR. The Thirty Years' War (1618-48) originated in the questions which were left unsettled at the time of the Reformation in Germany, but its duration was prolonged by French intervention, and its later stages were an episode in the conflict between France and the Habsburgs.

The agreement made at Augsburg (1555) between the Catholics and the Lutherans in Germany was based upon the right of the ruler of a state to determine its religious complexion (*cujus regio, ejus religio*); it necessarily made no provision for the later Protestant development inspired by the creed of Calvin; and it left uncertain many questions connected with Church property, and especially with the possessions of secularised bishoprics. There were several occasions before 1618 when a religious war seemed to be imminent, and the rival parties were grouped into the Calvinist Union (1608) and the Catholic League (1609).

The final crisis came with the accession to the Habsburg dominions (including Bohemia) of a ruler, Ferdinand of Styria, who was a bigoted Catholic and unlikely to continue the toleration which the Bohemian Protestants had secured from his predecessor, the Emperor Rudolph II. The Estates of Bohemia recognised Ferdinand as heir to the crown in 1617, but the Protestants rebelled, and (23rd May, 1618) threw the two regents of the kingdom out of a window in the palace at Prague. They appealed to the natural leader of the German Calvinists, Frederick V., Elector-Palatine, a son-in-law of James I. of England, who, without the consent of James, promised to accept the Bohemian throne.

The death of the old Emperor Matthias, in March, 1619, was followed by the election of Ferdinand as emperor in August, and in the same month the Bohemian Estates elected Frederick as King of Bohemia. A year later the Bohemians were defeated in the battle of the White Mountain (8th Nov., 1620). Frederick fled, and the Bohemian rebellion was suppressed. The conflict might have ended with this incident, but the emperor declared that Frederick had forfeited his own territory of the Palatinate, and conferred it upon his ally, Maximilian of Bavaria. This was a challenge to the whole of German Protestantism, besides offending Spain and England, and from the Bohemian revolution developed a European war. Other German princes came to Frederick's help, James I. gave him some assistance, which was increased by Charles I. in 1625, and Christian IV. of Denmark, who was interested in two secularised German bishoprics, became the leader of the Protestant cause.

The first great Protestant effort was defeated by two great imperialist generals, Tilly and Wallenstein, and in 1629 Christian was forced to make terms for himself (Treaty of Lübeck). But the emperor used his victory to demand, by the Edict of Restitution, the restoration of all ecclesiastical lands secularised since 1555, and this proposed economic revolution alienated the Lutherans and destroyed general confidence in the Constitution of the empire. A fresh intervention followed. Gustavus Adolphus of Sweden invaded Germany in 1630 as the champion of European Protestantism, and also with the aim of establishing Swedish supremacy on the coasts of the Baltic. Cardinal Richelieu (q.v.) gave him French help, and, though he failed to prevent the imperial army from sacking the Protestant town of Magdeburg, he won a great victory at Breitenfeld (17th Sept., 1631).

The violence of the imperial army led John George, Elector of Saxony, and leader of the Lutherans, to abandon his neutrality and join the Protestants, whose prospects seemed hopeful until Gustavus Adolphus (q.v.) was killed at Lützen (16th Nov., 1632). The struggle was continued by the Swedish statesman Oxenstjerna, and by Bernhard of Saxe-Weimar, but their chances of success were destroyed at Nördlingen (1634), and Saxony made peace with the emperor at Prague (1635).

The intervention of Gustavus Adolphus had saved Protestant Germany

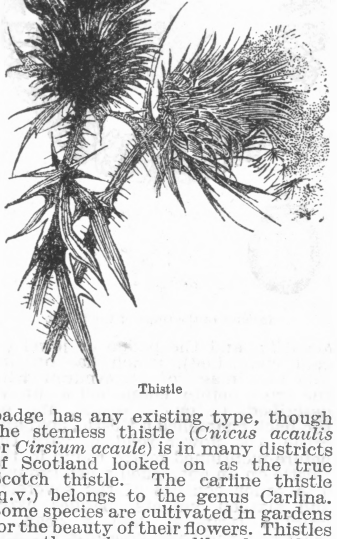
from the policy of the Edict of Restitution, and though the Treaty of Prague made no provision for the Calvinists, it was hoped that it might lead to a general peace. But Richelieu was determined to continue the war in order to weaken Austria and also Spain, with which the emperor was in close alliance. After the battle of Nördlingen, France became the leader of the German Protestants, and the war ceased to be a war of religion and became a conflict between the Bourbons and the Habsburgs, the Swedes continuing the struggle in order to acquire German territory.

French intervention on a large scale was not at first successful, but the tide had turned against the emperor and Spain before the death of Richelieu in 1642. His policy was continued by Mazarin, and in 1644-5 France conquered the Upper Rhineland, and the great French general Turenne reduced Bavaria (1646-8).

Meanwhile, negotiations for peace had been in progress. Germany was completely exhausted, and the death of the Emperor Ferdinand II. (1637) had long ago removed a serious obstacle to peace. A congress met at Münster (1644), and several of the German states made separate treaties, but it was not until 1648 that the German war was concluded by the Peace of Westphalia. The German Calvinists obtained legal recognition, and it was agreed that the ecclesiastical lands should remain in the possession of those who held them in 1624. The Lower Palatinate was restored to the son of Frederick V. (who had died in 1632), and Maximilian of Bavaria was given the Upper Palatinate. Sweden acquired Western Pomerania and the secularised bishoprics of Bremen and Verden, and Brandenburg, which lost Western Pomerania, received territorial compensation elsewhere. France obtained Austrian Alsace, and her right to the bishoprics of Metz, Toul, and Verdun was recognised. The Treaty of Westphalia marks the decline of the imperial ideal, for after the Thirty Years' War the empire became definitely Austrian. *See* AUSTRIA-HUNGARY; HOLY ROMAN EMPIRE; etc.—BIBLIOGRAPHY: S. R. Gardiner, *The Thirty Years' War*; A. Gindely, *History of the Thirty Years' War*; C. R. L. Fletcher, *Gustavus Adolphus*.

THISTLE. The common name of prickly plants of the tribe Cynaraceæ, nat. ord. Compositæ. There are numerous species, most of which are inhabitants of Europe, as the musk-thistle (*Carduus nutans*), milk-thistle (*C. Marianus*), welted thistle (*C. acanthoides*), slender-flowered thistle (*C. tenuiflorus*), the spear thistle (*Cnicus lanceolatus*), and field thistle (*Cnicus arvensis*), a well-known plant very troublesome to the farmer. The blessed-thistle, *Carduus benedictus* of the pharmacopœias, *Cnicus benedictus* or *Cirsium benedictum* of modern botanists, is a native of the Levant, and is a laxative and tonic medicine.

The cotton-thistle belongs to the genus Onopordum. The common cotton-thistle (*O. Acanthium*) attains a height of from 4 to 6 feet. It is often regarded as the Scotch thistle, but it is doubtful whether the thistle which constitutes the Scottish national



Thistle

badge has any existing type, though the stemless thistle (*Cnicus acaulis* or *Cirsium acaule*) is in many districts of Scotland looked on as the true Scotch thistle. The carline thistle (q.v.) belongs to the genus Carlina. Some species are cultivated in gardens for the beauty of their flowers. Thistles sow themselves readily by their winged seeds.

THISTLE, ORDER OF THE. A Scottish order of knighthood, sometimes called the Order of St. Andrew. It was instituted by James VII. (James II. of England) in 1687, when eight knights were nominated, fell into abeyance during the reign of William and Mary, and was revived by Queen Anne in 1703.

Insignia. The insignia of the order consist of a gold collar composed of thistles intermingled with sprigs of rue; the St. Andrew of gold enamelled, with the gown green and the surcoat purple, bearing before

him the cross enamelled white, and having round the image rays of gold going out from it in the form of a glory; the mantle of green velvet bound with taffeta and tied with cords and tassels of green and gold; on the left shoulder is a representation of the star of the order; the star, consisting of a St. Andrew's cross of silver embroidery, with rays emanating between the points of the cross; in the centre upon a field of gold, a a thistle of green, heightened with gold, and surrounded by a circle of green, having thereon the motto in letters of gold, *Nemo me impune*

Insignia of the Order of the Thistle

lacessit; and the badge or jewel (of gold enamelled), which has on one side the image of St. Andrew with the cross before, enamelled as above described, or cut in stone, and on the back enamelled a thistle, gold and green, the flower reddish, with the before-mentioned motto round it, the thistle on an enamelled green ground. The order consists of the sovereign and sixteen knights, besides extra knights (princes), and a dean, a secretary, the Lyon king-of-arms, and the gentleman usher of the green rod.

THOLEN. An island of the Netherlands, in the province of Zeeland, in the Schelde estuary. Tholen (pop. 3000) is the capital. There are fishing and spinning industries.

THOMAS, ST. Also called *Didymus*, one of the Twelve Apostles, said to have been a native of Antioch. The particulars of his life are unknown, the chief fact known regarding him being his doubts as to the living reality of Christ after the resurrection. He figures largely in the apocryphal gospels, and tradition has it that he acted as a Christian missionary in Ethiopia, Egypt, India, and even America.

THOMAS, Albert. French politician. He was born at Champigny-sur-Marné in 1878. His father, a baker, managed to give Albert a university education. In 1903 he became associated with Jean Jaurès, as assistant editor of *L'Humanité*. Elected to the Chamber of Deputies in 1910, he became Under-Secretary for Armaments in 1915, and Minister for Munitions in 1916. He left politics in January, 1920, to become the first Director of the International Labour Bureau at Geneva, where he worked strenuously for world peace. He died suddenly in Paris, 8th May, 1932.

THOMAS, Arthur Goring. English composer, born in 1850, died in 1892. His opera *The Light of the Harem* belongs to his student days. *Esmeralda* (1873) followed with great success, and his later operas are *Nadeshda* (1885) and *The Golden Web* (1893), the latter completed by another hand. His other works include: *The Sun-Worshippers* (1881; a choral ode), *Out of the Deep* and *The Swan and the Skylark* (cantatas), orchestral and violin pieces, songs, etc.

THOMAS, George Henry. American soldier, born in 1816, died in 1870. Educated at West Point, he took part in the Mexican War (1846-7); was appointed professor at West Point in 1850; recalled to active service in 1855, and employed in Texas against the Indians. When the War of Secession broke out, Thomas became brigadier-general of volunteers, and subsequently took part in the battle of Murfreesborough, while at the battle of Chickamauga, in Sept., 1863, he saved the Federal army from destruction by his stubborn resistance after the defeat of the Federal right. In the campaign of 1865 he defeated Hood, and compelled the Confederates to raise the siege of Nashville, for which he received the thanks of Congress.

THOMAS, James Henry. English politician, born at Newport, Monmouthshire, 3rd Oct., 1875; he began life as an errand boy, and became a railwayman as a cleaner on the G.W. Railway. In Swindon he came to the front both as a railwayman and in municipal affairs, and by 1910 was president of the Amalgamated Society of Railway Servants. He helped to reorganise the National Union of Railwaymen, becoming General Secretary in 1911. In 1910 he was elected to Parliament for Derby in the Labour interest, and has represented that constituency ever since. He was chairman of the Parliamentary

Committee of the Trades Union Congress, 1920-1, and president of the International Federation of Trade Unions, 1920-4. In the Labour Government of 1924 he was Colonial Secretary, and in the second Labour ministry of 1929 he was Lord Privy Seal, later becoming Secretary for the Dominions. In the crisis of 1931 he joined the National Government, again becoming Dominions Secretary, in which capacity he attended the Imperial Economic Conference at Ottawa in 1932. A popular and racy speaker, he published *When Labour Rules* in 1902.

THOMAS À KEMPIS. German mystic, born at Kempen in 1380, died in 1471. His proper surname was Hamerken or Hämmerlein (Little Hammer, Latinised as Malleolus), but he was called after his native town à Kempis. At the age of twelve he entered the School of the Brothers of Common Life at Deventer, and about 1399 he took up his residence in the Augustine monastery of Mount St. Agnes at Zwolle. Ordained priest in 1414, he lived absorbed in literary and pious labours, and was greatly esteemed for his saintliness.

His numerous Latin works include a chronicle of his monastery, sermons, hymns, moral treatises, and other writings. His fame, however, rests entirely upon his celebrated devotional treatise entitled *Imitatio Christi*. This work, which appeared anonymously, underwent several revisions, and is divided into four books. The *Imitatio Christi* has passed through an enormous number of editions in almost all languages, being the most widely distributed book after the Bible. The authorship has for some time been claimed for Jean Charlier de Gerson (1363-1429), chancellor of the University of Paris, but the work is now generally accepted as that of Thomas à Kempis.—BIBLIOGRAPHY: F. R. Cruise, *Outline of the Life of Thomas à Kempis*; J. E. G. de Montmorency, *Thomas à Kempis: his Age and his Book*.

THOMAS-GILCHRIST PROCESS. *See* STEEL.

THOMPSON, Francis. English poet, born 1859, died 1907. He was originally intended for the Roman Catholic priesthood, and was sent to Ushaw College; but afterwards studied medicine with little enthusiasm at Owens College, Manchester. After several years of obscurity and great privation, owing to which he acquired the habit of opium-eating, some of his poems were published in *Merrie England* in 1888. He was induced to enter a hospital and to abandon opium.

His first volume of *Poems* appeared in 1893; by far the most magnificent of these poems was *The Hound of Heaven*. *Sister Songs* followed in 1895, and *New Poems* in 1897. Thompson also wrote much prose, and contributed frequently to *The Athenæum*. *Health and Holiness* appeared in 1905, and after his death appeared a notable *Essay on Shelley*. Thompson was always an ardent Roman Catholic, and much of his work is inspired by a mystical religious fervour which makes it resemble the work of Crashaw.

THOMSON, Sir Charles Wyville. British naturalist, born in 1830 in Linlithgowshire, died in 1882. Educated at the University of Edinburgh, he became professor of mineralogy and geology in Queen's College, Belfast, in 1854. In the dredging expeditions of the *Lightning* and *Porcupine* (1868-9) he took part, afterwards publishing in *The Depths of the Sea* (1869) the substance of his discoveries in regard to the fauna of the Atlantic.

In 1869 he became Fellow of the Royal Society; in 1870 professor of natural history in the University of Edinburgh. In 1872 he was appointed scientific chief of the *Challenger* expedition, which was absent from England three and a half years, during which time 68,890 miles were surveyed. On his return he was knighted, and entrusted by the Government with the task of drawing up a report on the natural history specimens collected during the expedition. But he only lived to publish a preliminary account of the expedition, *The Voyage of the Challenger: the Atlantic* (1876-8). *See* CHALLENGER EXPEDITION.

THOMSON, James. Scottish poet, born in 1700 at Ednam, near Kelso, in Scotland, died in 1748. The son of a minister of Ednam parish, he was educated at Jedburgh and the University of Edinburgh, where *Winter*, the first of his poems on the seasons, was published in 1726. In 1727 he published his *Summer*, his *Poem to the Memory of Sir Isaac Newton*, and his *Britannia*, in 1728 his *Spring*, and in 1730 his *Autumn*.

After travelling for some time on the Continent with the son of Sir Charles Talbot, afterwards Lord Chancellor, he was rewarded with the post of Secretary of Briefs, which he held till the death of the Chancellor (1737), when he received a pension of £100 from the Prince of Wales. Meanwhile he had brought on the stage his tragedy of *Sophonisba* (1729) and published his poem on *Liberty*, the cool reception of which greatly disappointed him. He now (1738) produced his tragedy of *Agamemnon*, and a third entitled *Edward and Eleanora*. In 1740 he composed the

masque of *Alfred* in conjunction with Mallet; but which of them wrote the famous song *Rule, Britannia* is not known.

In 1745 his most successful tragedy, *Tancred and Sigismunda*, was brought out and warmly applauded. The following year he produced his *Castle of Indolence*, a work in the Spenserian stanza. He left a tragedy entitled *Coriolanus*, which was acted for the benefit of his relatives. Thomson was greatly beloved for his amiability and kindness of heart. His *Seasons*, on which his fame rests, abounds in beauty of natural description. His *Castle of Indolence*, though not so popular as the *Seasons*, is still read, but his tragedies are almost forgotten. —BIBLIOGRAPHY: Editions of works —George, Lord Lyttelton (1750); D. C. Tovey (1897); W. Bayne, *Life of James Thomson* (Famous Scots Series); Samuel Johnson, *Lives of the English Poets*; Léon Morel, *James Thomson: sa vie et ses œuvres.*

THOMSON, James. Physicist and engineer, born in Belfast in 1822, died in 1892. He succeeded Rankine as professor of engineering in Glasgow University in 1873, and held the chair till 1889. Some useful hydraulic devices which he invented testify to his skill and ingenuity in matters mechanical, but his most important work was in physics, and his name is most frequently mentioned now in connection with his discovery of the effect of pressure in lowering the freezing-point of water. He was a brother of Lord Kelvin.

THOMSON, James. Scottish poet, born at Port-Glasgow, Scotland, in 1834, died in 1882. He was brought up at the Caledonian Orphan Asylum, both his parents having died when he was very young. He became a schoolmaster in the army, but quitted that occupation in 1862, and became clerk in a solicitor's office. In 1860 he became a contributor to *The National Reformer*, in which was published, under the signature "B. V.," *The Dead Year*, *To our Ladies of Death*, and the poem by which he is best known, *The City of Dreadful Night* (1874). Among his other works are: *Tasso and Leonora* (1856), *The Doom of a City* (1857), *Sunday at Hampstead* (1863), *Sunday up the River* (1868), *A Voice from the Nile* (1881), and *Insomnia* (1882). Thomson's verse is characterised by much brilliancy and traits of graceful humour, but its prevailing tone is one of despair.—Cf. H. S. Salt, *Life of James Thomson.*

THOMSON, John. Scottish landscape painter, born in 1778, died in 1840. He succeeded his father as minister of the parish of Dailly, Ayrshire, in 1800, and exchanged that living for Duddingston, near Edinburgh, in 1805.

THOMSON, Sir John Arthur. British naturalist. He was born in East Lothian, 8th July, 1861, and studied at Edinburgh, Jena, and Berlin Universities. He held the post of lecturer in biology and zoology at the Edinburgh School of Medicine, and in 1899 was appointed regius professor of Natural History at Aberdeen University, where he remained till his retirement in 1930. His works include *Secrets of Animal Life* (1919), *Science and Religion* (1925), and *Outline of Biology* (1930). He died in 1933.

THOMSON, Joseph. Scottish traveller and explorer, born at Penpoint, Dumfriesshire, 1858, died in 1895. In 1882 he explored the Rovuma in East Africa, and in 1884 made an important journey through Masai Land, in eastern equatorial Africa. Among his other achievements were expeditions to the Atlas Mountains, the Rivers Niger and Benue, Zambezia, etc.

THOMSON, Sir Joseph John. British physicist, born 1856; he graduated as second wrangler in 1880. From 1884 to 1918 he was Cavendish professor of physics, and in the latter year became master of Trinity College, Cambridge. He was elected to a special professorship of physics in 1919. The Royal and Hughes medals and the Nobel prize (1906) are among his distinctions. He became president of the Royal Society in 1915, was knighted in 1908, and was awarded the O.M. in 1912. His works include textbooks of physics (written in collaboration with Professor Poynting), *Recent Researches in Electricity and Magnetism*, and *Conduction of Electricity through Gases.*

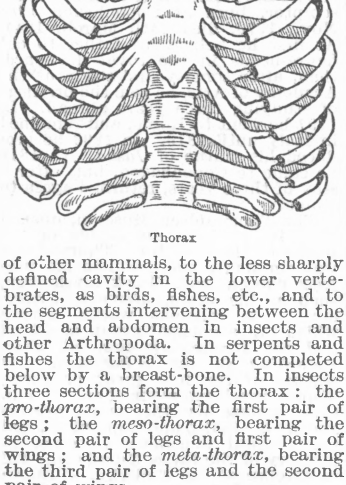
THOMSON, Thomas. Scottish chemist, born at Crieff in 1773, died in 1852. He published in 1802 his *System of Chemistry*, containing the first detailed account of Dalton's atomic theory.

THOMSON, William. British prelate, born at Whitehaven 1819, died 1890. He was educated at Shrewsbury School and Queen's College Oxford, of which he was successively Fellow, tutor, and provost. In 1851 he was chosen preacher of Lincoln's Inn, and in 1859 was appointed one of Her Majesty's chaplains in ordinary. Two years later (1861) he was raised to the episcopal bench as Bishop of Gloucester and Bristol; but before he had held the appointment twelve months he was transferred to the archbishopric of York.

Dr. Thomson was the author of a number of works, including: *An Outline of the Necessary Laws of Thought*; *The Atoning Work of Christ, viewed in Relation to some Current Theories*; *Crime and its Excuses*; *Life in the Light of God's Word* (sermons); *Limits of Philosophical Inquiry*; *Design in Nature*; and a series of essays entitled *Word, Work, and Will*.

THOR. Son of Odin by Jörd (the earth), the Jupiter of Teutonic mythology, the god of thunder. He was represented as a powerful man in the prime of life, with a red beard, girt with his girdle of strength, and armed with his mighty hammer *Miölnir* (the smasher). *Thursday* has its name from him. *See* NORTHERN MYTHOLOGY.

THORAX. The chest, or that cavity of the human body formed by the spine, ribs, and breast-bone, situated between the neck and the abdomen. It contains the pleura, lungs, heart, etc. The name is also applied to the corresponding portions



Thorax

of other mammals, to the less sharply defined cavity in the lower vertebrates, as birds, fishes, etc., and to the segments intervening between the head and abdomen in insects and other Arthropoda. In serpents and fishes the thorax is not completed below by a breast-bone. In insects three sections form the thorax: the *pro-thorax*, bearing the first pair of legs; the *meso-thorax*, bearing the second pair of legs and first pair of wings; and the *meta-thorax*, bearing the third pair of legs and the second pair of wings.

THOREAU (thō'rō), **Henry David.** American naturalist and author, born at Boston in 1817, died in 1862. He was educated at Harvard University, where he graduated in 1837. From that time till 1840 he was engaged as a schoolmaster. Then for several years he occupied himself in various ways, in land-surveying, carpentering, and other handicrafts, but devoting a great part of his time to study and the contemplation of nature. In 1845 he built for himself a hut in a wood near Walden Pond, Concord, Massachusetts, and there for two years lived the life of a hermit. After quitting his solitude, Thoreau pursued his father's calling of pencil-maker at Concord.

Besides contributing to the *Dial* and other periodicals, he published *A Week on the Concord and Merrimac Rivers* (1849) and *Walden, or Life in the Woods* (1854). After his death appeared *Excursions in Field and Forest*, *The Maine Woods*, *Cape Cod*, and *A Yankee in Canada*. Thoreau was a friend of Emerson, and imbibed much of his spirit and method of thought.

THORITE. Mineral thorium orthosilicate, crystallising like rutile, and with a specific gravity of 5. It is sought after as a source of thorium for the incandescent-mantle trade, and is strongly radio-active. *See* MONAZITE.

THORIUM. A rather rare metal; symbol, Th; atomic weight, 232·15. It is mainly obtained from monazite sand, and also occurs in the mineral *thorite*. Its oxide, ThO_2, is known as thoria, and together with ceria, the oxide of cerium, forms one of the essential constituents of the ordinary incandescent gas mantles. Thoria is radio-active, and a gas mantle placed on a photographic plate affects the plate and photographs itself upon it.

THORN, properly **TORUN.** A town and strong fortress of Poland, on the Vistula. It consists of an old and a new town, and has several churches, one of them containing a statue of Copernicus, who was born there. It has manufactures of machinery, soap, and a famous gingerbread.

Founded by the knights of the Teutonic order in 1232, it was annexed to Poland in 1454. In 1793, at the partition of Poland, it reverted to Prussia, and was, from 1807 to 1813, part of the Grand-Duchy of Warsaw. It was given to Poland by the Treaty of Versailles, and named by the Poles Torun. Thorn is an important railway junction on the Schneidemühl-Insterburg line via Schönsee (for Bromberg or Bydgoszcz) and lines to Posen (q.v. *see* PRUSSIA, EAST) and Alexandrowo. Pop. 39,419.

THORNABY-ON-TEES. A municipal borough and market town of England, in the North Riding of Yorkshire, on the Tees. It is opposite Stockton, and was formerly known as South Stockton. Engineering establishments, iron foundries, sawmills, and flour-mills are among employments. Pop. (1931), 21,233.

THORNDYKE, Dame Sybil. English actress. She was born at Gainsborough, 24th Oct., 1885, and educated at the High School, Rochester, and the Guildhall School of Music, London. She studied at Ben Greet's Academy, and made her début at Oxford, June, 1904, as Phyllis in *My Lord from Town*. She then toured in the United States in Shakespeare répertoire with Ben Greet. Later she was with the Horniman Company in Manchester. Her London début was in 1908 at the Scala, and in the same year she married Mr. Lewis Casson. She was seen at her best as Jane Clegg in the play of that name by St. John Ervine, and as Joan of Arc in Shaw's *Saint Joan*. She was made a D.B.E. in 1931, and started on an Australian tour in March, 1932.

THORNE. Market town of Yorkshire (W.R.). It is 11 miles from Doncaster and 166 from London by the L.N.E. Railway, and is situated on the Don. Rope is made, and there is an agricultural trade. There is a fourteenth-century church. Near is Thorne Water, a stretch of peat moor. Pop. (1931), 6076.

THORNE, Will. English politician. He was born in Birmingham, 8th Oct., 1857, and began life at six in a barber's shop. In 1889 he helped to found the National Union of General and Municipal Workers, and has been general secretary since; he has represented West Ham in the Labour interests since 1906, and has been a member of the West Ham Town Council since 1890, being mayor, 1917-8. He was created C.B.E. in 1930. He published *My Life's Battles* in 1925.

THORNHILL, Sir James. English painter, born in 1676, died in 1734. He was much engaged in the decoration of palaces and public buildings, in which his chief works are to be found. Among his best efforts may be mentioned the dome of St. Paul's, the saloon and refectory at Greenwich Hospital, and some rooms of Hampton Court. His forte was in the treatment of allegorical subjects.

THORNTON. Urban district of Lancashire. It is 16 miles from Preston, on the L.M.S. Railway. Pop. (1931), 10,144.

Another **Thornton,** 5 miles from Bradford, Yorks, was the birthplace of the Brontë sisters. Another is a railway junction in Fifeshire.

THORNTON HEATH. District of Croydon. It lies to the N. of the borough and is a residential area for Londoners, the city being 8 miles away. It is on the Southern Railway, and is united by tramways with Croydon and London.

THORNYCROFT, Sir William Hamo. British sculptor, born in 1850. He first exhibited at the Academy in 1871. In 1875 he gained a gold medal from the Academy for a group representing *A Warrior bearing a Wounded Youth from the Field of Battle*. His other works include: the national memorial to General Gordon in Trafalgar Square, London; *Medea*; *The Mirror*, his diploma work; *The Mower*; *Lot's Wife*; and *The Kiss*. He died in 1925.

THORPE, Benjamin. An English scholar who greatly furthered the study of Anglo-Saxon, born 1782, died 1870. Among his numerous publications are: an English edition of Rask's *Anglo-Saxon Grammar*, *Ancient Laws and Institutes of the Anglo-Saxon Kings*, *The Gospels in Anglo-Saxon*, an edition of *Beowulf*, *The Anglo-Saxon Chronicle*, *Northern Mythology*, etc.

THORWALDSEN (tor'vâld-sèn), **Albert Bartholomew (Bertel).** Danish sculptor, born at Copenhagen 19th Nov., 1770, died 24th March, 1844. At first he helped his father to cut figure-heads in the royal dockyard, then, after some years' study at the Academy of Arts, he won the privilege of studying three years abroad. In 1797 he went to Rome, and remained in Italy until 1819. In 1809 he produced his statue of *Jason*. In 1819 he came to Copenhagen, but, after a stay of three years, returned again to Rome.

The Thorwaldsen Museum, opened in 1846, contains about 300 of the works of the sculptor. Thorwaldsen was eminently successful in his subjects chosen from Greek mythology, such as his *Mars*, *Mercury*, *Venus*, etc. His religious works, among which are a colossal group of *Christ and the Twelve Apostles*, *St. John Preaching in the Wilderness*, and statues of the four great prophets, display much grandeur of conception. Chief among his other works are his statues of Galileo and Copernicus, and the colossal lion near Lucerne, in memory of the Swiss Guards who fell in defence of the Tuileries.—BIBLIOGRAPHY: J. M. Thiele, *Life of Thorwaldsen*; E. Plon, *Thorwaldsen: sa vie et son œuvre*; C. A. Rosenberg,

Thorwaldsen (Künstler-monographien, No. 16).

THOTH. An Egyptian deity identified by the Greeks with Hermes (Mercury), to whom was attributed the invention of letters, arts, and sciences. The name is equivalent in significance to the Greek Logos, and Thoth is a mythical personification of the divine intelligence. He is represented with the head of an ibis or a dog. There were forty-two sacred books under his name, which were under the guardianship of the Egyptian priests.

THOU (tō), **Jacques Auguste de.** French statesman and historian, born in 1553, died in 1617. Henry IV. employed him in several important negotiations, and in 1593 made him his principal librarian. In 1595 he succeeded his uncle as Chief Justice, and during the regency of Mary de' Medici he was one of the directors-general of finance. His greatest literary labour was the composition in Latin of a voluminous history of his own times (*Historia sui Temporis*), comprising the events from 1545 to 1607, of which the first part was made public in 1604. To this work, which is remarkable for its impartiality, he subjoined interesting *Mémoires*.

THOUROUT (tō-rō). A town of Belgium, in the province of West Flanders. Manufactures include cloth, chicory, and leather. There is an agricultural trade. Captured by the Germans in 1914, it was retaken by Belgian troops on 16th Oct., 1918. Pop. 11,000.

THOUSAND ISLANDS. A group of small islands, numbering about eighteen hundred, in the St. Lawrence immediately below Lake Ontario. They partly belong to Canada and partly to the state of New York, and have become a popular summer-resort.

THRACE. The south-easternmost region of Europe. The region considered here is bounded on the west by the Maritsa (Maritza) and on the north by Bulgaria, and, excepting the Chatalja, is coextensive with Turkey in Europe after the armistice of Mudania and the Conferences of Lausanne.

Physical. Thrace comprises (1) an almost treeless Central Plateau, flanked by (2) the Istranja mountain system, and fringed by (3) coastal regions, which are low everywhere but the Dardanelles, and border the Ægean, the Sea of Marmara, and the Black Sea.

Three divisions of the Istranja mountain system may be distinguished: (1) the wooded gneiss- and granite-hills of the Istranja Dagh, flanking the Central Plateau on the north, and trending south-eastwards to join the heights of the Chatalja Peninsula; (2) the extension of the Istranja Dagh south-westwards as the Tekfur Dagh, and its prolongation into Gallipoli Peninsula; and (3) the Kuru Dagh, which is separated from (2) by the valley of the Kavak Dere, a river flowing southwards into the Gulf of Saros (Xeros). The Chatalja hills (about 600 feet) extend across the Chatalja Peninsula between Derkos Geul (Lake) on the north and the Kuchuk Chekmeje lagoon (Sea of Marmara), and form an impenetrable fortified outpost of Istanbul, of gigantic size, protected in front by the Ak Dere and behind by the Kara Su, rivers that may be called natural moats. Magiada (3394 feet altitude) is the highest point of the Istranja Dagh; Pirgos (3024 feet) and Chatal Tepe (1169 feet) are highest in (2) and (3) respectively.

The Tekfur and Kuru hills enclose the Central Plateau on the south, and north of them is the Yaila Dagh, culminating in Rudeli Dagh (1050 feet altitude). Between the southern mountains and the Central Plateau, however, there lies the deep, broad, flat valley of the Ergene, which drains the Plateau and flows to join the Maritsa (ancient *Hebrus*), the principal river of Thrace, some 26 miles above its embouchure. The streams of Thrace are so numerous that no small map shows them all.

In the south-west corner of Thrace the climate is Mediterranean, but winters are colder; elsewhere, excepting Istanbul, the region is transitional between the Mediterranean and the Steppes, with winter rains and very cold north winds. In the Maritsa Valley (south-west) the olive is found. Istanbul, which, on account of its geographical situation, is rather warmer, forms in itself a climatic subdivision.

Production. Thrace has been devastated by frequent wars, and is not greatly developed agriculturally. The chief crops are maize, wheat, oats, barley, and oil-seeds; cotton is grown on Gallipoli; sericulture is progressive in South-Western Thrace; the vine and viticulture are ubiquitous, but are especially noted in the Marmara and Dardanelles coast regions.

Forestry has suffered from indiscriminate felling. Oak, beech, plane, birch, pine, and elm are representative of the Belgrade Forest (Chatalja Peninsula), and of the wooded slopes of the main Istranja range, behind which live-stock (cattle, sheep, and goats) are grazed. The fisheries of

the Marmara yield chiefly mackerel, but also sardines, tunny, bass, and mullet (red and grey). Manufactures are of no importance.

Some coal is worked at Keshan (pop. 30,000), for which place Ibrije is the port; but Keshan is connected by rail with the great Oriental trunk line that forms a link between Istanbul (*see* SYSTEMS, RAILWAY, sections 6 (*h*) and 14 (*f*)) and Central Europe. Rodosto (q.v.), where there are lignite-mines, is the chief port.[1]

Towns. Besides those places already mentioned, the chief are Edirne (Adrianople), Gallipoli, Silivri, Chorlu, Lule Burgas, Hairobolu, and Malgara.

History. From earliest historic times Thrace has been a convenient ground whereon contending kings, statesmen, and nations have submitted their differences to the arbitrament of the sword; and, as a highway out of the east into the west, it has passed under the sway of many rulers.

Beginning with the Greeks, who founded a number of maritime settlements but did not attempt to explore the hinterland, *Thracia* formed, with *Europa*, *Libya*, and *Asia*, the whole of the known world, or the postulate that passed as such; but the designation was subsequently narrowed down to embrace only the region south of the *Haemus* mountain chain, and east and north-east of Macedonia.

Darius crossed Thrace in 513 B.C., and it was subdued by one of his generals. Xerxes was unopposed in his march during 480 B.C., but after Salamis the Greeks regained the territory, which again fell to the Persians and Spartans after the Peloponnesian War. Philip II. of Macedon later succeeded in subduing a large section. His work was continued by Alexander the Great, upon whose death Thrace was the portion allotted to Lysimachus. Ptolemy Euergetes annexed the country to Egypt (247 B.C.), and under the Ptolemies it remained for half a century.

Under the Romans, Thrace was at first left entirely to native rulers, but was made a province in 46 B.C. Thracians fought for Pompey against Cæsar. Under Augustus the Thracian princes bore the same relationship to Rome as do the Indian potentates to the British Crown in modern times. On the division of the Roman Empire (A.D. 395), Thrace was attached to the eastern or Byzantine half. In A.D. 255 appeared the Goths, followed by Alaric in 395 and Attila in 447, and in 1341 the Osmanlis crossed to Europe and captured (1453) the Thracian stronghold Constantinople (now Istanbul).

Under the Romans, Thracian troops were largely employed as light infantry, and the Thracian gladiators, of whom Spartacus (q.v.) was one, were justly famous. The native Thracians were generally of exceptional military ability, and were greatly in demand as mercenaries in classical times; and the inherent weakness of their state is ascribed by Herodotus to discord and jealousy among the various clans, who could not be persuaded to combine for war, excepting for freebooting expeditions of short duration.

The reign of Sitalces of the Odrysæ dynasty was the golden age of Thracian sovereignty. On his death in battle (424 B.C.) the nephew of Sitalces succeeded him as Seuthes I., whose reign marks the beginning of the decay of Odrysian power.

Modern History. In 1520 Turkish power reached its zenith (see map under TURKEY). During 1875 a great revolutionary movement began, in the course of which several new states appeared. In 1877 Russia declared war on Turkey, and the Grand Duke Nicholas took Adrianople, pushing on to San Stefano, which he made his headquarters. By arrangement with Great Britain, however, Constantinople was not entered, and the Treaties of San Stefano and Berlin (3rd March and 13th July, 1878, respectively) concluded the campaign.

First Balkan War. The foregoing treaties were more or less the creators of Bulgaria, Serbia, and Rumania as states. During the rise to power of the Young Turk party, Venizelos and Tsar Ferdinand of Bulgaria formed a League of Balkan States, of which Serbia, Bulgaria, Greece, and Montenegro were members (*see* BALKAN LEAGUE). This League declared war on Turkey (1912), and the success of its arms was overwhelming, the Turkish army making a final desperate stand on the Chatalja lines. By the Treaty of London (30th May, 1913), negotiated through the intervention of the Powers, war was nominally at an end; but it had only just begun, for the victors now began to quarrel over the spoils, and the rapacity of Bulgaria provoked a second war among the former allies.

Second Balkan War. Serbia and Greece became allies against Bulgaria, and Rumania cast a suspicious eye upon all three, for she had a frontier grievance against Bulgaria, and Serbia was her only possible ally against that country. On 29th June, 1913, the war began, Bulgaria assuming the offensive against Serbia and

[1] The bulk of Turkish coal comes from the Heraclea Basin in Anatolia (see *Songuldak*).

Greece. Rumania then invaded Bulgaria, and reached Sofia without firing a shot, after having overrun the whole of Northern Bulgaria. Meanwhile Turkey marched into Thrace, seized Adrianople (now Edirne), entered Bulgaria, and then sat down to await the customary diplomatic *parlers*, which usually, on the Turkish side, are confined to *demander un bœuf pour avoir un œuf*.

Eventually the Treaty of Bucharest was negotiated, and was ratified by all concerned on 25th Aug., 1913. Bulgaria received a southern egress to the Ægean, between the Mesta River on the west and the Lower Maritsa on the east, and the eastern frontier between Turkey and Bulgaria remained substantially the same under the Turko-Bulgar Treaty of Constantinople (29th Oct., 1913). *See* BALKAN WAR.

European War. On the outbreak of war the Turkish frontier on the north was bounded by the line of the Rezvaya River, some 30 miles north of Midia, and swung south-eastward on crossing the Tunja to enclose Adrianople, crossing the Maritsa, which it joined and followed from below Demotika to the Ægean, the unhealthy delta being allotted to Turkey. After the European War (q.v.) Turkey was dismembered, and Bulgaria was deprived of her outlet to the Ægean. The Turks were shut in by the Chatalja lines, and Constantinople had an Allied garrison, while the rest of Thrace was handed over to the Greeks. Mustafa Kemal's campaign during 1922 again made it necessary to consider some territorial readjustments, and at the Conference of Lausanne (1922-3) it was agreed to return to Turkey the whole of Eastern Thrace up to the Maritsa line, thus reverting practically to the old frontier arrangements of the Treaty of Constantinople, except that Greece lies west of the Maritsa and not Bulgaria. Adrianople is included in the Turkish territory. *See* EUROPEAN WAR (section *Turkey and the War*), and GALLIPOLI.

THREAD. A slender cord consisting of two or more yarns, or simple spun strands, firmly united together by twisting. The twisting together of the different strands or yarns to form a thread is effected by a thread-frame or doubling and twisting machine, which accomplishes the purpose by the action of bobbins and flyers. Thread is used in some species of weaving, but its principal use is for sewing.

The manufacture of sewing thread in the United Kingdom both for home use and export is very extensive. As a general rule, the thread manufactured for home use, and for export to the United States, is much superior to that made for other markets, which is of an inferior quality. The thread made for home use is commonly known as six-cord, and that for export as three-cord thread. The chief seat of the cotton thread manufacture in Scotland is Paisley, in England Manchester. Linen thread is manufactured largely in Ireland, as well as in Scotland. The fine flax lines or flax threads are used for sewing valuable articles, while the coarser flax threads are used extensively in the manufacture of nets of various kinds.

THREAD-WORMS. The name for thread-like intestinal worms of the order Nematoda. The *Oxyuris vermicularis* occurs in great numbers in the rectum of children particularly.

THREATENING. By the common law of England to threaten bodily hurt is a civil injury against the person, and pecuniary damages can be recovered for interruption of a man's business through fear of such threats. Any person accusing or threatening to accuse any other person of crimes, with the view to extort gain, is guilty of felony. Provisions are made against sending or delivering any letter threatening any house, ship, etc., or to wound or main cattle; and sending or delivering any threatening letter demanding any property or valuable. Any person who threatens to publish a libel with intent to extort money is guilty of a misdemeanour, and any person who maliciously sends or delivers, knowing the contents, any letter threatening to kill or murder any person is guilty of a felony.

The intimidation of workmen to induce them to yield to combinations or associations is forbidden by an Act of 1875, the penalty being a fine not exceeding £20, or imprisonment for a term not exceeding three months. Various modes of intimidation are prohibited by the Trade Disputes and Trade Unions Act, 1927. "Peaceful picketing," however, and certain acts of interference in furtherance of trade disputes were legalised by the Trade Disputes Act, 1906.

THREE RIVERS. A city and port of Quebec, Canada, in St. Maurice county, at the confluence of the St. Maurice and St. Lawrence; served by the Canadian Pacific Railway. There is a daily river-steamer service, and the concrete wharfage has depth enough alongside to accommodate the deepest vessels afloat. Paper-pulp, lumber-milling, cotton, iron-founding, steel, leathers, boots and

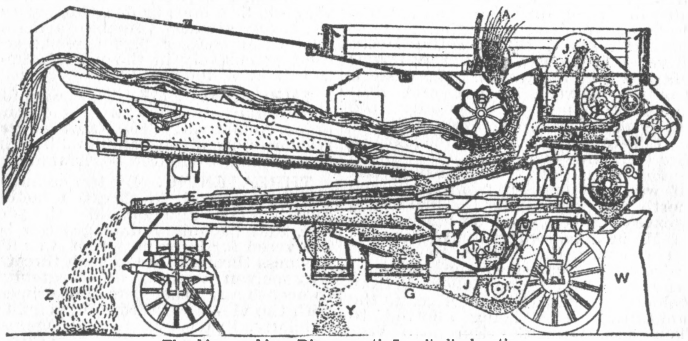
shoes, furniture, confectionery and food-stuffs are some of the industrial activities. Pop. (1931), 35,450.

THRESHER-SHARK, also called the *Fox-shark*. A genus of sharks containing but one known species (*Alopecias vulpes*), with a short conical snout, and less formidable jaws than the white shark. The upper lobe of the tail fin is very elongated, being nearly equal in length to the rest of the body. It is used to crowd together the herrings, pilchards, sprats, etc., on which this species preys, by splashing the water as the thresher swims round and round the shoal. Tail included, this shark attains a length of 15 feet. It inhabits the Atlantic and the Mediterranean, and is sometimes met with on the coasts of Britain. *See* SHARK.

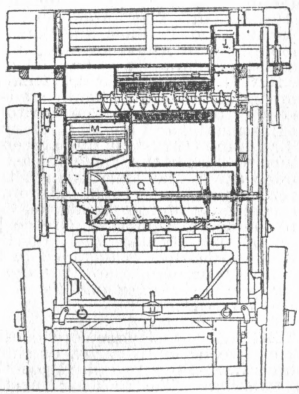
THRESHING-MACHINE, or **THRASHING-MACHINE.** A machine for separating grain from the straw, in which the moving power is that of horses, oxen, wind, water, or steam. The threshing-machine was invented in Scotland in 1758 by Michael Stirling, a farmer in Perthshire; it was afterwards improved by Andrew Meikle, a millwright in East Lothian, about the year 1776. Since that time it has undergone various improvements. With a portable engine (a traction-engine), the machine can be moved from farm to farm, performing the threshing work of a wide district for the whole season. Power is often supplied by various types of internal-combusion engines, and tractors can also be used for this purpose.

The following is a description of the operations which take place in the "Ruston" Single- and Double-crank Finishing Threshing-machines.

The corn is fed into the top of the machine at A, between the drum and the concave, and the threshing or beating of the grain out of the ear is effected by the *drum* B, which revolves at a high speed. The threshed straw is carried by the *shakers* C, and passed out of the machine on to the straw-board ready for stacking. Everything which has fallen through the concave or the shakers on to the collecting-board, or *top shoe* D, is



Threshing-machine: Diagrammatic Longitudinal-section

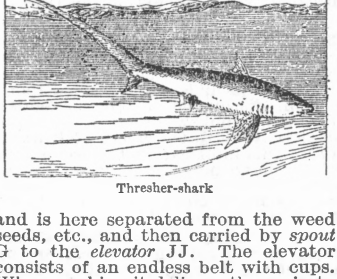


Diagrammatic Cross-section

carried to the inclined part of the shoe in the centre of the machine, and from there passes on to the *caving riddle* E, through which all the chaff and grain falls. The cavings, free from corn, leave the machine at the end of the shoes E, and pass out to the ground at Z, under the straw-board.

The grain and chaff below the riddles pass on to the *collecting-board*, which forms the bottom part of the shoe, through an opening, where they encounter a strong blast from the *large blower* H. By this blower the chaff is then driven out over the chaff-board and collected at Y, being at the same time thoroughly separated from weed seeds, etc.

The winnowed grain now falls through a series of *dressing riddles* F,



Thresher-shark

and is here separated from the weed seeds, etc., and then carried by *spout* G to the *elevator* JJ. The elevator consists of an endless belt with cups. When working it delivers the grain to the top of the machine, where it is permitted by means of the *slide* I to pass into the *smutter* K, or into the *creeper* L. Bearded, or husky, wheat and barley is carried through the smutter; other grain which should not pass through the smutter, as, for instance, damp or smutty wheat, is conveyed by the creeper direct to the opposite side of the machine. The grain here reaches the *second dressing apparatus* and falls on the *riddles* M, passing at the same time through a blast of air from the *second blower* N.

The blower carries away the beards and any other impurities still remaining with the grain. The grain thus cleaned and winnowed for a *second time* passes into the *rotary screen* Q, which sorts the grain according to size and delivers it through the separate outlets into the *sacks* W.

If the rotary screen, however, be not required, the grain can be shut off by means of a *hinged lid*, and allowed to fall through the passage direct to the sacks.

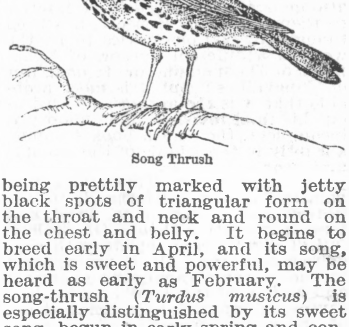
THRIPS. A genus of minute insects, the type of the order of Thysanoptera, or fringe-winged insects. They live on flowers, or plants, or under the bark of trees. *T. cerealium* is a common British species, scarcely a line in length or in extent of wing, lurking in the husks and sucking the undeveloped grains of cereals, especially wheat, to which it is most injurious.

THROAT. The anterior part of the neck of an animal, in which are the œsophagus and windpipe, or the passages for the food and breath. *See* LARYNX; ŒSOPHAGUS; TRACHEA; DIPHTHERIA; CROUP; etc.

THROMBO'SIS is the formation of a clot in the heart or in one of the blood-vessels. The clot may block the vessel, and, by interference with the circulation, lead to serious results.

THRUSH. The name applied popularly to several perching birds. The true thrushes (Turdidæ or Merulidæ) form a family of dentirostral passerine birds, including the song-thrush or throstle, the missel-thrush, the blackbird, etc. They feed upon berries, small molluscs, worms, etc. Their habits are mostly solitary, but several species are gregarious in winter. They are celebrated on account of their powers of song; and are widely diffused, being found in all the quarters of the globe.

Species. The missel-thrush (*Turdus viscivŏrus*), the largest of the British resident species, attains a length of 11 inches, and is coloured a reddish-brown on the upper parts and yellowish-white below, the under surface



Song Thrush

being prettily marked with jetty black spots of triangular form on the throat and neck and round on the chest and belly. It begins to breed early in April, and its song, which is sweet and powerful, may be heard as early as February. The song-thrush (*Turdus musicus*) is especially distinguished by its sweet song, begun in early spring and continuing even to November or December. The colour is a brown of different shades on the upper parts, the chin being white, and the belly and under tail-coverts a greyish-white. Its average length is 9 inches. The eggs, numbering five, are blue, spotted with black. The nest is large

and basin-shaped, composed of roots, mosses, etc., smoothly plastered inside with clay. The thrush family also includes the fieldfare, redwing, and ring-ouzel.

THRUSH. A disease common in infants who are ill fed. (*See* APHTHÆ.) The name is also applied to an abscess in the feet of horses and some other animals.

THRUST-PLANE. In geology, a reversed fault with a low angle of inclination to the horizon, along which rocks have been moved so as to override others of younger age. Conspicuous examples are traced in the north-west Highlands of Scotland and in the Alps.

THUCYDIDES (thö-sid'i-dēz). The greatest of all the Greek historians, born in Attica about 471 B.C. He was well born and rich, being the possessor of gold-mines in Thrace, and was for a time a prominent commander during the Peloponnesian War, which forms the subject of his great work. For many years he suffered exile (being accused of remissness in duty); but appears to have returned to Athens the year following the termination of the war, namely, in 403 B.C. He is said to have met a violent death, probably a year or two later, but at what exact time, and whether in Thrace or Athens, is not known.

His history consists of eight books, the last of which differs from the others in containing none of the political speeches which form so striking a feature of the rest, and is also generally supposed to be inferior to them in style. Hence it has been thought by various critics to be the work of a different author, of Xenophon, of Theopompus, or of a daughter of Thucydides; but it is more probable that it is the author's own without his final revision. The history is incomplete, the eighth book stopping abruptly in the middle of the twenty-first year of the war.

As an historian Thucydides was painstaking and indefatigable in collecting and sifting facts, brief and terse in narrating them. His style is full of dignity and replete with condensed meaning. He is unsurpassed in the power of analysing character and action, of tracing events to their causes, of appreciating the motives of individual agents, and of combining in their just relations all the threads of the tangled web of history. — BIBLIOGRAPHY: Editions — T. Arnold (1848-51); Bloomfield (1842-43); Classen (1862-78). Translations —Bloomfield (1829); H. Dale (Bohn Classical Library); B. Jowett. General works—G. B. Grundy. *Thucydides and the History of his Age*; W. C. Wright, *A Short History of Greek Literature*; F. M. Cornford, *Thucydides Mythistoricus*.

THUGS. The name applied to a secret and once widely spread society among the Hindus, whose occupation was to waylay, assassinate, and rob all who did not belong to their own caste. This they professed to do, partly at least, from religious motives, such actions being deemed acceptable to their goddess Kali. Between 1830 and 1835 the Government took active measures against them, and Thuggery became practically extinct by 1848.

THULE (thö'le). The name given by the ancients to the most northern country with which they were acquainted. According to Pliny the Elder, it was an island in the Northern Ocean, discovered by the navigator Pytheas, who said that it was six days' voyage to the north of Britain. From this information historians and others have postulated in succession the Orkneys, Shetlands, Iceland, and even the Norwegian coast to be the real Ultima Thule.

THUN (tön). A town of Switzerland, in the canton of Bern, at the exit of the Aar (q.v.) from the Lake of Thun. It is a Swiss military centre and the commercial metropolis of the Bernese Oberland. It is served by the main trunk line Paris-Basel, and has lines to Burgdorf (*via* Konolfingen) Brig (for Simplon Tunnel), and (electric) Interlaken, as well as steamer service to Lake ports. Pop (1930), 16,428.

THUN. A lake of Switzerland, in the canton of Bern. It is 1840 feet in altitude, 10 miles long, 2 miles broad and about 720 feet deep. At its south eastern extremity it receives the surplus waters of the Lake of Brienz by the Aar, which again emerges from its north-western extremity.

THUNDER. The violent sound which follows a flash of lightning (q.v.). Dr. Steinmetz has suggested the following as the probable average characteristics of the discharge: potential gradient at moment of discharge, 50,000 volts per foot; potential difference between discharge points and the cloud, 50,000,000 volts; current, 10,000 amperes; duration, 0·0001 second; frequency, 500,000 cycles per second; energy, 10,000 kilowatt-hours.

THUNDER-FISH. A species of fish of the family Siluridæ, found in the Nile, which, like the torpedo, can give an electric shock. It is the *Malapterūrus electricus* of naturalists.

THURGAU (tur'gou) or **THURGOVIE.** A canton of North-Easte

Switzerland; area, 386 sq. miles. It is not so mountainous as other Swiss cantons. The chief language is German. The whole canton belongs to the basin of the Rhine, and is drained by the Thur and its affluents. Large quantities of fruit are grown. Frauenfeld (pop. 8000) is the capital. It is an industrial town and was the Swiss capital from 1712 to 1798. Pop. (canton, 1930), 136,063.

THÜRINGERWALD (tü'ring-ĕrvâlt), or **THURINGIAN FOREST.** A mountain range of Central Germany. The Beerberg (3225 feet altitude) and Schneekopf are the culminating points.

THURINGIA. A republic of Germany, one of the constituent states of the German Reich, formed, from an assortment of former grand-duchies and principalities, as follows:

State	Area, Sq. M.	Pop. 1920
Saxe-Weimar-Eisenach ..	1,397	270,000
Saxe-Meiningen	953	191,500
Gotha	546	434,000
Saxe-Altenburg	511	211,700
Reuss	441	212,000
Schwarzburg-Rudolstadt ..	363	99,400
Schwarzburg-Sondershausen	333	93,400
Republic of Thuringia ..	4,544	1,512,000

The capital is Weimar. The population (1925) was 1,196,244. Thuringia is mainly agricultural, but there are salt-mines and large potash works.

Component States. By "Thuringian States" was understood all the states tabulated above, with the addition of Saxe-Coburg; or—and it really amounts to the same thing—all those states occupying the region bounded by the Prussian provinces of Hesse-Nassau and Saxony, Bavaria, and the Kingdom of Saxony.

Saxe-Weimar-Eisenach, a duchy comprising the detached districts of Weimar, Eisenach, and Neustadt, and twenty-four lesser enclaves embedded in neighbouring states. Weimar (the capital), Jena, Apolda, and Eisenach were the chief towns.

Saxe-Meiningen, a duchy with its capital at Meiningen.

Saxe-Coburg-Gotha, a duchy formed by the combination of the discrete duchies of Coburg and Gotha under one ruling house. Coburg and Gotha, the chief towns, give their names to the respective states, and the latter was capital of the united duchy.

Saxe-Altenburg, a duchy having Altenburg as capital.

Reuss, two principalities: (1) the Younger Branch, with Gera as capital; and (2) the Elder Branch, reigning over 122 sq. miles of territory, with Greiz as capital.

Schwarzburg-Sondershausen, a principality with capital at Sondershausen.

Schwarzburg-Rudolstadt, a principality with capital at Rudolstadt. All of these states were overwhelmingly Protestant (evangelical) in religion, and Protestantism is therefore the strongest religion in the republic, all other faiths being relatively insignificant.

The Union. After the Revolution of Nov., 1918, when the ruling houses were deprived of their power, there was a decided movement towards the union of the Thuringian states. Saxe-Coburg-Gotha, however, had been held together by a purely personal bond, through the reigning house, and with the exit of the duke, Gotha and Coburg drifted apart, and resumed political power as separate entities. On the other hand, the removal of the princes of Reuss paved the way for the union of these two small states, which combined on 4th April, 1919, to form a People's State of Reuss. Meanwhile negotiations were proceeding, and on 1st May, 1920, the union of all the Thuringian states was proclaimed.[1] The country is now divided into 10 towns and 15 country districts, and one sub-district. There is one Diet (elected by proportional representation), which elects a ministry. No President of the Republic has been provided for, and a President of the Council, a sort of chairman, is elected by the ministry. The referendum principle is in operation.

THURLES. A town, Irish Free State, in the county of Tipperary, on the Suir. There is a castle and a cathedral, and Thurles is the see of a Roman Catholic bishop. Pop. (1926), 4796.

THURLOW, Edward, first Baron. English lawyer and politician, born in 1732, died in 1806. Educated at Cambridge, he entered the Middle Temple, and was called to the Bar in 1754. In 1761 he became King's Council. Returned to Parliament for Tamworth (1768), he was made Solicitor-General (1770), Attorney-General (1771), and Lord Chancellor (1778), being raised to the peerage as Baron Thurlow. He was compelled to resign office in 1783, but he was still considered the confidential adviser of the king, and at the close of the year the Great Seal was restored to him by Pitt. He continued to hold office when in 1788 the king's illness rendered it necessary to consider the

[1] Coburg merged in the Republic of Bavaria.

contingency of a regency. Pitt suspected Thurlow of intriguing with the Prince of Wales, and from this time an open disagreement took place between them. Pitt demanded his dismissal, to which the king at once agreed, and he was deprived of the Great Seal (June, 1792).—Cf. E. Foss, *Judges of England, with Sketches of their Lives.*

THURSDAY (that is, "Thor's day"). The fifth day of the week, so called from the old Teutonic god of thunder, Thor. Thursday was called by the Romans *Dies Jovis* (whence the French *jeudi*), Thor being identified with Jupiter. The German name Donnerstag is of similar origin; and *Thor, Donner* are equivalent to English *thunder*.

THURSDAY ISLAND. An island of Queensland, in Normanby Sound, Torres Straits. It is a fortified Government station, and the harbour—Port Kennedy—is one of the finest in this quarter. It is in the direct track of all vessels reaching Australia by Torres Straits, and is the centre of a large and important pearl and bêche-de-mer fishery. Pop. 1800 (500 white).

THURSLEY. Village of Surrey. It is near Hindhead and is known for its picturesque common. The parish church is partly Saxon. Iron was once worked in the neighbourhood and the hammer ponds are still seen.

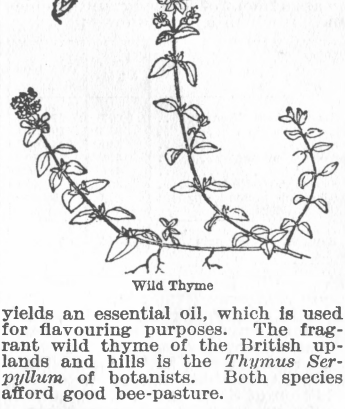
THURSO. A seaport-burgh of Scotland, in the county of Caithness, on the Bay of Thurso. It is the starting-place for steamers for the Orkney and Shetland Islands. The chief trade is grain, cattle, agricultural produce, and paving-stones. Pop. (1931), 2946.

THURSTON, Ernest Temple. English novelist and playwright. He was born 23rd Sept., 1879, and at sixteen had published two books of poems. His *City of Beautiful Nonsense* (1909) brought him into prominence, and *The Garden of Resurrection* (1911) increased his reputation. Since 1905 he has published thirty-eight novels, three volumes of poems, and ten plays. He died in 1933.

THYESTES (thī-es'tēz). In Greek mythology, son of Pelops and Hippodamia, and grandson of Tantalus. He seduced the wife of his brother Atreus, who, in revenge, served up to him the body of his own son at a feast. *See* ATREUS.

THYL'ACINE (*Thylacinus cynocephălus*). A carnivorous marsupial mammal inhabiting Tasmania, but now approaching extinction. It is known as the Tasmanian wolf. In size it is generally about 4 feet in total length, though some specimens attain a much greater size. It is nocturnal in its habits, of a fierce disposition, and very destructive to sheep and other animals. It has a long and somewhat dog-like muzzle, and a long tapering tail; the fur is greyish-brown with a series of bold transverse stripes, nearly black in colour, beginning behind the shoulders and ending at the tail.

THYME (tīm; *Thymus vulgāris*). A small plant of the nat. ord. Labiatæ, a native of the south of Europe, and frequently cultivated in gardens. It has a strong aromatic odour, and



Wild Thyme

yields an essential oil, which is used for flavouring purposes. The fragrant wild thyme of the British uplands and hills is the *Thymus Serpyllum* of botanists. Both species afford good bee-pasture.

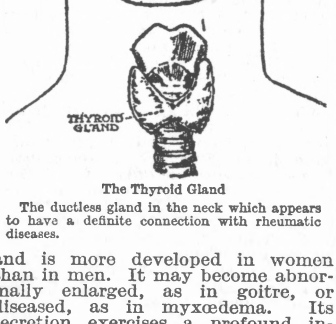
THYMELEA'CEÆ. The Daphne family, an order of apetalous dicotyledons, consisting of shrubs or small trees, rarely herbs, with non-articulated, sometimes spiny branches, with tenacious bark. The leaves are alternate and opposite, and the flowers spiked and terminal. The fruit is nut-like or drupaceous. The species are not common in Europe; they are found chiefly in the cooler parts of India and South America, at the Cape of Good Hope, and in Australia. *See* DAPHNE; LACE-BARK TREE.

THYMOL, $C_{10}H_{14}O$. A crystalline substance obtained from the oil of thyme and other plants. The crystals, which are colourless and have the odour of thyme, are very insoluble in water. At one time it was used in medicine as an antiseptic lotion and gargle, and given as an intestinal

antiseptic, but now it is only used as an anthelmintic in hook-worm disease (*see* ANKYLOSTOMIASIS). For this purpose it is usually administered in capsules.

THYMUS GLAND. A ductless glandular organ situated in the middle line of the body. It reaches its greatest relative size about the time of birth, and continues to grow until puberty, when it begins to decrease in size. It is covered in front by the breast-bone, and lies on the front and sides of the windpipe. Its secretion is believed to co-operate with that of other glands in stimulating growth, and to exercise an inhibitory influence upon the central nervous system.

THYROID GLAND. A ductless structure in man which covers the anterior and inferior part of the larynx and the first rings of the windpipe. It is of a reddish colour,



The Thyroid Gland

The ductless gland in the neck which appears to have a definite connection with rheumatic diseases.

and is more developed in women than in men. It may become abnormally enlarged, as in goitre, or diseased, as in myxœdema. Its secretion exercises a profound influence upon the activity of certain other glands and the sympathetic nervous system.

THYSANU'RA (" fringe-tailed "). A sub-order of apterous insects that undergo no metamorphosis, and possess two or three slender hairy processes projecting from the tip of the tail. The silver fish (*Lepisma saccharina*) is found in brown sugar, and another common species (*Campodea staphylinus*) abounds in decaying wood, gardens, and fields.

TIA'RA (Gr. *tiara*). Originally the cap of the Persian kings. The tiara of the Pope is a high cap, encircled by three coronets with an orb and cross of gold at the top. Nicholas I. (858-67) was the first to unite the princely crown with the tiara. The second crown was added before the time of Innocent III. Urban V. (1362-70) added the third crown. The tiara is a symbol of temporal power; at ceremonies of a purely spiritual character the Pope wears whichever of his four mitres is most suitable for the occasion.

Tiara

TI'BER (It. *Tevĕre*, ancient **Tiberis**). A river of Italy, rising in the Apennines, in Tuscany, and, after a course of about 245 miles, falling into the Mediterranean. It traverses the city of Rome, forming the island anciently called Insula Tiberina. About 90 miles of its course are navigable for small vessels; those of about 140 tons burden reach Rome. It is subject to floods, and carries down quantities of yellowish mud, hence its designation " the Yellow Tiber."

TIBERIAS. A town, Palestine, on the Sea of Galilee. Pop. 7000.

TIBERIAS, LAKE OF. *See* GALILEE, SEA OF.

TIBERIUS, in full, **Tiberius Claudius Nero Cæsar.** A Roman emperor, born 42 B.C., died A.D. 37. He was the son of Tiberius Claudius, of the ancient Claudian family, and of Livia Drusilla, afterwards the wife of the Emperor Augustus. Tiberius became consul in his twenty-eighth year, and

was subsequently adopted by Augustus as his heir.

In A.D. 14 he succeeded to the throne without opposition. Dangerous mutinies broke out shortly afterwards in the armies posted in Pannonia and on the Rhine, but they were suppressed by the exertions of Germanicus and Drusus. The conduct of Tiberius as a rule was distinguished by an extraordinary mixture of tyranny with occasional wisdom and good sense.

Tacitus records the events of the reign including the suspicious death of Germanicus; the detestable administration of Sejanus; the poisoning by that minister of Drusus, the emperor's son; and the infamous and dissolute retirement of Tiberius (A.D. 27) to the Isle of Capreæ, in the Bay of Naples, never to return to Rome. The death of Livia in A.D. 29 removed the only restraint upon his actions, and the destruction of the widow and family of Germanicus followed. Sejanus fell a victim to his ambition in the year 31.—BIBLIOGRAPHY: Sabine Baring-Gould, *The Tragedy of the Cæsars*; J. C. Tarver, *Tiberius the Tyrant*; C. Merivale, *History of the Romans under the Empire*.

TIBET. A country occupying the south portion of the great plateau of Central Asia. It stretches from the Pamir between the Himalayas and the Kunlun to the borders of China proper, and is bounded by India, Nepal, Bhutan, China, Mongolia, and Sinkiang; area, 463,200 sq. miles; pop. *c.* 2,000,000. It is a country of great mountain ranges (several peaks are over 23,000 feet high), vast plateaux (average elevation 10,000 feet), and undulating plains. In Tibet are the headwaters of many great rivers (Indus, Brahmaputra, Hwang Ho, Yangtze Kiang, etc.), and there are numerous lakes (salt and fresh) over 10,000 feet above sea-level.

Owing to the former complete exclusion of strangers and to climatic and other conditions, the country is imperfectly explored. The climate generally is characterised by the excessive dryness of the atmosphere and the severity of the winter. There is some agriculture, and cereals (mainly barley) and fruits (even peaches) are produced. The pastoral industry is important, the principal animals being the yak, the fat-tailed sheep, and the Kashmir goat, with some camels and buffaloes. Wool spinning, weaving, etc., are carried on. Minerals include gold, borax, and salt, with some copper, iron, and silver.

There is a large trade with China, and the annual value of exports to India is *c.* £300,000 (mainly raw wool). Trade with India has to be carried by yaks across lofty passes 14,000 to 18,000 feet high. The main routes are from Siliguri, near Darjeeling in India, to Gyangtse and Yatung in Tibet, and from Almora and Simla in India to Gartok in Western Tibet. The religion of Tibet is Lamaism (q.v.), though Shamanism is also practised. The head of the Government is the Dalai Lama, who resides in the Po-ta-la, near Lhasa (the capital), and exercises his powers through a regent (also a lama) and five ministers.

History. China has exercised a certain influence over Tibet since 1720, and up till 1908 there were Chinese officials in charge of military and foreign affairs. In 1890 and 1893 treaties regarding trade between India and Tibet were made with China, and to secure Tibetan observance of these Colonel (now General Sir Francis) Younghusband took an expedition to Tibet in 1903. He reached Lhasa in 1904, and a convention was signed. Yatung, Gyangtse, and Gartok became open marts. China ratified this in 1906. Subsequent conventions were concluded in 1907 (Britain and Russia) and 1908 (Tibet and India), all of which recognised Tibet's dependency on China.

After the Chinese revolution of 1911 the Tibetans expelled the Chinese garrison, and in 1912 Britain made it clear that she recognised Chinese suzerainty only over Tibet and that the 1906 convention must be adhered to. There was much wrangling owing to China's desire to annex Tibet, but at length a Tripartite Conference met at Simla in 1913. No settlement, however, has ever been made.—Cf. Sir F. E. Younghusband, *India and Tibet*.

TIBUL'LUS, Albius. Latin elegiac poet, born about 54 B.C., and died about 19 B.C. Very little is known about his life, and even his gentile name is uncertain. It would seem that he had inherited a large estate most of which was confiscated in 41 B.C. His patron was M. Valerius Messalla Corvinus, whom he possibly accompanied to Gaul in 30 B.C. Two years later he started to go with Messalla to the East, but, owing to illness remained at Corcyra. He probably spent much of his time on his country estate. The literary circle of Messalla was only slightly less brilliant than that of Mæcenas, and Tibullus was the most distinguished member of the circle.

The genuine works of Tibullus consist of two books of elegiac poems. Most of the poems which form the first book are addressed to his mistress Delia (Plania was her real name), a grass-widow whose husband was absent on military service in Cilicia. In the second book the poet addresses another mistress, with the ominous name of Nemesis.

Tibullus was a man of a gentle and retiring disposition, a valetudinarian, and something of a conscientious objector to the strenuous life. His poems are valuable, not for the account they give of his somewhat sentimental love-affairs, but for their descriptions of country life, and for that finish and gracefulness that made Quintilian place their author at the head of Latin elegists. There is little or no Alexandrian learning in Tibullus, who is always simple in his thoughts, clear in his language, and smooth in his metre.

The third book of "Tibullus" (sometimes erroneously divided and called the third and fourth books) is a collection of poems by different members of the circle of Messalla, a collection not unfittingly appended to the scanty works of the greatest member of that circle. Some of these are by Lygdamus, a cultured freedman and a foreigner; others are by Sulpicia, usually considered to have been Messalla's niece. Their poems are good, though greatly inferior to those of Tibullus; but the *Panegyric on Messalla* is one of the worst pieces of rubbish that antiquity has handed down.—Cf. W. Y. Sellar, *Horace and the Elegiac Poets*.

TIC DOULOUREUX (dŏ'lō-rē). A painful affection of a facial nerve, a species of neuralgia. It is characterised by acute pain, attended with convulsive twitchings of the muscles, and continuing from a few minutes to several hours. It occurs on one side of the face, and may be caused by a diseased tooth, by inflammation in the ear passage, by exposure to cold, by dyspepsia, etc. The removal of the cause is the natural remedy; and warm applications, the employment of electric currents over the nerve, and morphia administered subcutaneously are sometimes effective.

TICHBORNE CASE. A *cause célèbre* in English law, a classic example of "the law's delays" and of the facility with which many persons can be deceived. Roger Charles Tichborne (1829-54) was a member of the wealthy Roman Catholic family of Tichborne, which had valuable property in Hampshire. The baronetcy in the family dates from 1621. In 1853 Roger went a trip to South America. He sailed from Rio de Janeiro in 1854 on the *Bella*, which was lost at sea with all hands. His will was proved, and no one disbelieved in his death except his mother, a French woman of neurotic temperament. In answer to her advertisements, a person appeared in 1866 claiming to be Sir Roger Tichborne (the title would have been Roger's since 1862 if he had been alive). Roger Tichborne had been slim, with sharp features and straight black hair; the "claimant" was a mountain of flesh (he weighed 24 stone) and had wavy light-brown hair. Roger had been partly brought up in France, and spoke French like a native; his English, while not beyond reproach, was that of a public school boy and cavalry officer; the claimant was entirely unacquainted with French, and his English was that of an illiterate man.

In spite of these and many other discrepancies, the claimant had innumerable enthusiastic not to say fanatical supporters. The first trial (1872) lasted 103 days; at the end of it the claimant's counsel elected to be non-suited. The claimant was put on trial for perjury, and after a trial lasting 188 days he was found guilty and sentenced to fourteen years' penal servitude. It was proved that his real name was Arthur Orton, and that he was a native of Wapping. Orton died in 1898, having in 1895 admitted his identity. The trial cost the Tichborne family £90,000.—Cf. J. B. Atlay, *The Tichborne Case*.

TICINO (ti-chē'nō; Ger. and Fr. *Tessin*). A river of Switzerland and North Italy, rising in Mount St. Gothard, and after a course of about 120 miles joining the Po on the left. It traverses Lake Maggiore and separates Piedmont from Lombardy.

TICINO (Ger. and Fr. *Tessin*). A canton of Southern Switzerland; area, 1085 sq. miles. The northern and greater part of the canton is mountainous, the Splügen, St. Bernardin, and Mount St. Gothard forming its northern boundary. The chief river is the Ticino, and Lake Maggiore is partly within the canton. Production comprises cattle-raising and dairying in the north, and viticulture, oil, and cereals in the south. The chief towns are Bellinzona (the capital), Locarno, and Lugano. Pop. (1930), 159,223 (mainly Italian-speaking Roman Catholics).

TICKELL, Thomas. English man of letters, born in 1689, died in 1740. His success in literature and in life was mainly due to Addison, who procured for him in 1717 an Under-Secretaryship of State. In 1725 he

was appointed secretary to the Lords Justices of Ireland, a post he held till his death. His chief works are: *Prospect of Peace*, a ballad entitled *Colin and Lucy*, and a fine elegy on the death of Addison.

TICKHILL. Urban district of Yorkshire (W.R.). It is 6 miles south of Doncaster, and 158 from London by the L.N.E. Railway. There is a ruined castle. Pop. (1931) 2297.

TICKS. The largest members of the Acarida or order of mites, class Arachnida. They are parasitic animals, possessing oval or rounded bodies, and a piercing and sucking proboscis, by which they attach themselves to dogs, sheep, oxen, and other mammals. Birds and reptiles are also annoyed by the attacks of certain species. The common sheep-tick (q.v.) is a familiar example. Some ticks spread the germs of diseases caused by protozoan parasites, e.g. Texas fever of cattle, also known as "red-water."

TICONDERO'GA. A village and township of Essex county, New York, United States. It stands on the stream connecting Lakes George and Champlain, and figured prominently during the colonial and revolutionary period, having a fortress built by the French in 1755.

TICUL. A ruined Maya city of Yucatan, Mexico, 31 miles south of Mérida on the railway Mérida-Peto (145 miles).

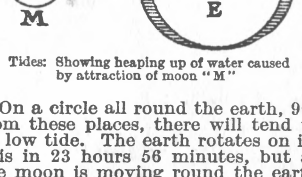
TIDES. The periodical rising and falling of the waters of the ocean. The tides are said to *flow* and *ebb*, the maximum height being attained at *high water*, the minimum at *low water*. The words *flow* and *ebb* are also applied to the stream or current which in the shallower seas is a noticeable accompaniment of the variation of level. The tides are caused by the attractions of the moon and sun.

Generally speaking, there are two high waters and two low waters in the lunar day of 24 hours 50 minutes, so that each day the high waters are about 50 minutes later; but this interval is variable, being shorter about new and full moon, and longer about the quadratures.

Although the sun attracts the earth, and also the sea, with enormously greater force than does the moon, the latter body has a tide-producing power rather more than twice as great as the sun's. This is because the effect depends on the *difference* of attraction on the earth and the sea, and, on account of the moon's proximity, the earth's radius is a much larger fraction of the moon's distance than it is of the sun's.

The varying depths of the ocean, and its interruption by the large and irregular continental masses, cause great complications in the tides, and no simple theory gives anything like a complete explanation of them. What is known as the *equilibrium theory*, however, gives a view of the subject comprising the broad features of the case, though requiring much modification when applied to the actual terrestrial conditions.

The moon attracts the water on the side next to it more strongly than it does the earth as a whole, or we may say more strongly than it attracts the earth at its centre. The waters, therefore, tend to be heaped up here, producing a high tide. The moon attracts the water on the distant side less strongly than it attracts at the earth's centre. This difference operates as a force tending, as in the former case, to urge the water away from the earth's centre. Therefore here also the waters tend to be heaped up, as a high tide.



Tides: Showing heaping up of water caused by attraction of moon "M"

On a circle all round the earth, 90° from these places, there will tend to be low tide. The earth rotates on its axis in 23 hours 56 minutes, but as the moon is moving round the earth the same way, it takes any particular meridian about 24 hours 50 minutes to perform a revolution relatively to the moon; hence the two high and two low tides in that interval.

At either new or full moon, the sun, earth, and moon are situated in one straight line. The sun's and moon's tide-producing forces are therefore combined, and we have the highest or *spring tides*. At the moon's first and last quarters, that is, at half moon, the sun is acting at right angles to, and thus opposing, the moon's tidal action, and we have the lowest or *neap tides*, which represent the effect of the moon minus that of the sun.

Every fortnight there are therefore spring tides, and at the intermediate times neap tides.

In strict accordance with the theory outlined above, high water at any place would occur when the moon was on the meridian, or twelve hours from it. There would thus be high water *at noon* on the day of new or

full moon. In actual fact, it may be at any time whatever on these days, but the time is approximately constant for one place. The interval from noon at which high water occurs at a place on the day of new or full moon is called the *establishment of the port*.

The question which now naturally arises is, "if the water tends to pile up opposite these two bodies (and at the antipodal points), and the moon's influence is twice as great as the sun's, why is it not everywhere high water approximately when the moon crosses the meridian at the given place?" There are two principal reasons why this is not the case. The first is a fundamental one, and is in accordance with the theory of forced oscillations. The tidal wave set up by an external body, say the moon, is compelled to travel round the encircling ocean at the same rate as the moon herself; it is, in fact, a forced oscillation. The vital problem which the mathematician has to solve is the speed with which this wave would continue to travel round the earth if the tide-generating forces were suddenly removed.

He finds that in our particular case it would travel much more slowly than the forced wave, and theory then indicates that the crest of the forced wave lags so much behind the moon that it is actually reversed in position, that is to say there is actually low water immediately under the moon, and high water at places 90° away from there. The latter state of affairs is further modified by friction, since water, though very mobile, does offer frictional resistance to relative movements within itself.

The second reason is that the ocean, instead of being continuous over the face of the earth, is split up by great continents, so that the only region of the earth where the tidal wave has a free passage round it is the Southern Ocean. Wherever the ocean is restricted into more or less closed areas, be they even so large as the Atlantic Ocean, the tide-generating forces have far less scope.

In the Mediterranean Sea the true tides are scarcely perceptible, and such as occur are much masked by secondary oscillations resulting from causes other than the lunar and solar action. But that true tides occur, even in very small bodies of water, is beyond doubt; and Professor Michelson of the United States has succeeded, by exceedingly delicate methods, in measuring the tides in a closed pipe 500 feet long.

The result of the interference of land masses is that nearly all the observed tides at the world's principal ports are offshoots of the main tidal wave in the Southern Ocean. Especially is this the case for the whole of the Atlantic and Northern European coasts. The tides which proceed northwards up the Atlantic Ocean are "free" waves like the rollers visible on a windy day, though many hundreds of miles long from crest to crest. The varying depth of the ocean through which they pass, and the irregular outline of the coasts bounding them, modify them profoundly.

The tidal waves travel with great speed for thousands of miles, and carry their influences into the more landlocked seas, inlets, firths, and river-mouths, where their speed is greatly reduced, but their height increased. There are several tidal waves traversing the earth simultaneously, each later one being some 12½ hours younger than the preceding. Before they have penetrated to the most distant recesses, they are three or four days old. It will thus be evident why high water may occur at different places at any hour in relation to the moon's position.

The greatest tidal wave originates in the Pacific, near the South American coast, travels across that ocean, unites with a lesser wave born in the Indian Ocean, rounds the Cape, joins an Atlantic wave, and proceeds north. Another part of the Pacific wave enters the Atlantic via Cape Horn. The tides which reach British coasts are from one and a half to two and a half days old at different ports; hence the spring tides are a day or two after new and full moon.

The Straits of Dover being so narrow as very greatly to obstruct tidal passage, our eastern coasts receive their tides round the north of Scotland. At certain places, as, for example, near the Straits of Dover, two sets of tidal waves, which have come by different routes, meet. If the two sets differ in phase by about six hours, the result is that they practically counteract each other and maintain a constant water-level.

To show the passage of the tide waves over the oceans of the earth, *co-tidal charts*, giving the positions of the crests of the waves at successive intervals of one hour, have been constructed, but the correct positions are still very uncertain for some regions.

The tides perform their oscillations so ceaselessly and with such apparent regularity that it is not to be wondered at that attempts have been made from early times to predict the height of the water at given places for long periods ahead, a prediction

which, if successful, offers immense advantages to navigators.

Until Lord Kelvin developed the so-called *harmonic analysis* of the tides, such methods of prediction as existed were based upon the examination of long series to tidal records with a view to the detection of peculiarities in them which could be correlated with the simpler elements of the moon's and sun's movements. In many cases a secret was made of the more successful methods.

Harmonic analysis, a powerful weapon in this and other fields, seeks to disentangle from an irregularly periodic phenomenon the various harmonic oscillations, some short and some long, which are known from theory to be the probable cause of the complexity of the phenomenon. The motions of the moon and sun relative to the earth have been studied to such good purpose by astronomers that it is possible to calculate mathematically a number of periodicities in the "tide-generating potential."

A search for these same periodicities in the recorded tides of any given place is then made, and the result is invariably to reduce the records to something like order, although to this day tidal analysis and prediction are susceptible of great improvement and are receiving the intensive study which they deserve. At Liverpool, attached to the university, is the Tidal Institute, which carries on this work and publishes an annual report on its progress.

Although the tides at many places of observation are "free" oscillations in the sense that they have travelled over vast distances from the regions in which they received their main generating impulses, yet it is, in theory, impossible for any given periodicity impressed on them there to be damped out.

The relative intensities of these component oscillations are greatly modified as the tidal wave passes through areas of water of the most varied depth, breadth, and outline, and apparent new short periodicities are the result of its passage into the shallow waters of the immediate coastal or estuarine areas.

The same influences cause the ranges of the tides to differ greatly from place to place in landlocked seas. At Cherbourg the spring tide is 20·7 feet, while on the Dorset coast opposite it is little more than 6 feet. Between Wexford and the waters of the Bristol Channel there is a still greater difference.

The height of the water at a given time and place, besides being subject to the regular oscillations described above, is influenced by atmospheric pressure and by winds, being depressed when the barometer rises, and vice versa. The wind effect may on occasion assume serious proportions, as when a disastrous coastal flood is caused by a gale.—BIBLIOGRAPHY: Sir G. H. Darwin, *The Tides and Kindred Phenomena in the Solar System*; H. D. Warburg, *Tides and Tidal Streams*; The Tidal Institute, Liverpool University, *Annual Reports*; W. H. Wheeler, *A Practical Manual of Tides and Waves*; H. Lamb, *Hydrodynamics*.

TIECK (tēk), **Johann Ludwig.** German poet of the romantic school, born 1773, died 1853. Educated at Halle, Göttingen, and Erlangen, he began his literary work by the writing of tales and romances, e.g. *Abdallah*; the novel *William Lovell* (three vols.); *Peter Lebrecht: a History without Adventures*; and *Volksmärchen von Peter Lebrecht*. At Jena, in 1799-1800, he entered on friendly relations with the Schlegels, Novalis, Brentano, and others, and through this association arose what has been denominated as "the Romantic School of Germany."

In 1799 he published *Romantische Dichtungen* (two vols.), and (1804) his comedy *Kaiser Octavianus*. His *Phantasus* (three vols. 1812-1817) gave the first sign of his having freed himself from the mysticism and extravagance of his earlier works. In 1817 he visited England, where he collected material for his *Shakespeare*.

His *Collected Novels* (twelve vols., 1853), raised him to the front rank of contemporary literature. They include: *Dichterleben* (A Poet's Life—Shakespeare); *Der Tod des Dichters* (The Poet's Death—Camoens); *The Witches' Sabbath*; and *Aufruhr in den Cevennen* (Revolt in the Cevennes), an incomplete work. In 1826 he published his *Dramaturgische Blätter*. His study of Shakespeare resulted in *Shakespeares Vorschule*, and the continuation of the German translation of Shakespeare commenced by Schlegel. His last story of importance was *Vittoria Accorombona* (1840). — Cf. Carlyle, *Essay on Tieck*.

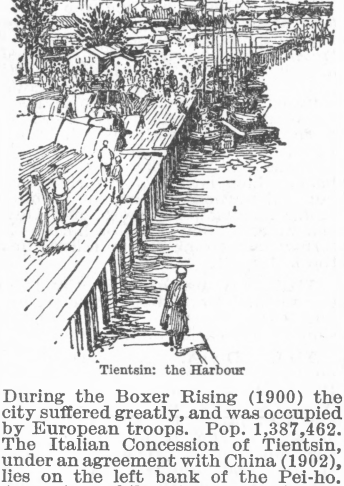
TIEL. A city of Holland, in the province of Gelderland, on the Waal and the Elft-Dodrecht Railway. Farm tools, tobaccos, and salt are made. Pop. 12,370.

TIEN SHAN. *See* THIAN SHAN.

TIENTSIN'. A treaty port of Chihli North China, the river-port of Peiping with which it communicates by the Pei-ho River. This river is only

navigable by native craft, and large vessels anchor outside its mouth, in the Taku roadstead. In winter (December to April) the river is ice-bound. There is railway communication with Peiping, Manchuria, etc. There is a large trade in European goods.

The Taku forts were taken by the British and French in 1860, and Tientsin opened to foreign trade.



Tientsin: the Harbour

During the Boxer Rising (1900) the city suffered greatly, and was occupied by European troops. Pop. 1,387,462. The Italian Concession of Tientsin, under an agreement with China (1902), lies on the left bank of the Pei-ho. Area, ¼ sq. kilometre; pop. (1931), 6261.

TIER'RA DEL FUE'GO. An archipelago occupying the southern extremity of South America, separated from the mainland by the Strait of Magellan. It consists of one large island (Tierra del Fuego) and several smaller, with a total area of about 32,000 sq. miles, and is divided between Argentina (area, 8344 sq. miles; pop. (1932), 3796), and Chile, the respective capitals being Punta Arenas and Ushuaia.

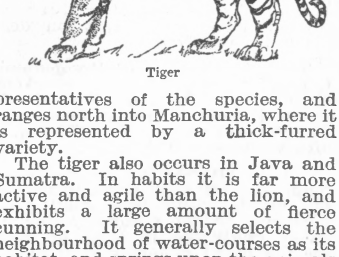
The whole region is mountainous, but considerable areas are suited for pasturage, and large sheep-farms are common. The climate is moist and chilly. The natives (about 1000 only) are fast nearing extinction. Tierra del Fuego was discovered by Magellan in 1520, and received its name (Land of Fire) from the fires he saw on its coast at night.

TIÉRS-ÉTAT. *See* STATES-GENERAL.

TIFLIS. The capital of the Republic of Georgia, and of Transcaucasia, on the Kur. Manufactures include cotton and silk, leather, and soap. The artisans of Tiflis are celebrated as silversmiths, gun-smiths, and sword-makers. The town is served by the Transcaucasian Railway, and the foreign trade of Transcaucasia with Asia is mostly carried on from Tiflis. Pop. (1931), 347,900.

TIFLIS. A former government of Transcaucasia, Russia, now a province of the Georgian S.S.R. It is mountainous, and belongs entirely to the basin of the Kur (q.v.), the soil in the upper valley of which is of extraordinary richness, but the Steppe region in the lower reaches is dry and requires irrigation. Agriculture (wheat, maize, cotton, etc.) and stock-raising are progressive; copper (in the Lialvar Mountains), Glauber's salt, lead (Upper Kur Valley), antimony, and pyrites for sulphur are among minerals worked. About 1½ million acres of virgin forest await exploitation.

TIGER (*Felis tigris*). A well-known carnivorous mammal, possessing, in common with the lion, leopard, etc., five toes on the front feet and four on the hinder feet, all the toes being furnished with strong retractile claws. The tiger is about the height of the lion, but the body is longer and the head rounder. It is of a bright fawn colour above, a pure white below, irregularly crossed with black stripes. The tiger attains its full development in India, the name of "Bengal tiger" being generally used as synonymous with those specimens which appear as the typical and most powerful representatives of the species, and ranges north into Manchuria, where it is represented by a thick-furred variety.



Tiger

The tiger also occurs in Java and Sumatra. In habits it is far more active and agile than the lion, and exhibits a large amount of fierce cunning. It generally selects the neighbourhood of water-courses as its habitat, and springs upon the animals that approach to drink. "Man-

eaters" are tigers which have acquired a special liking for human prey. The natives destroy tigers by traps, pits, poisoned arrows, and other means.

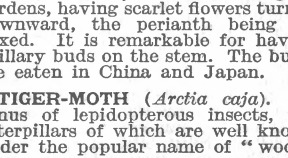
TIGER-BEETLE (*Cicindēla campestris*). A species of beetles which is swift and active in its movements, and preys upon other insects. The larva is equally rapacious.

TIGER-CAT. A name of not very definite signification, sometimes given to some of those animals of the family Felidæ which are of middling size, and resemble the tiger in their form or markings, such as the chati, the margay, the ocelot, the serval, etc. (q.v.).

TIGER-FLOWER (*Tigridia pavonia*). A Mexican bulbous plant of the nat. ord. Iridaceæ, frequently cultivated in gardens on account of the magnificence of its flowers. The stem is about 1 foot in height, with sword-shaped leaves. The flowers are large, of a singular form, and very evanescent. The petals are of a fine orange-red towards the extremity; whitish or yellowish and beautifully spotted at the base.

TIGER-LILY (*Lilium tigrīnum*). A native of China, common in English gardens, having scarlet flowers turned downward, the perianth being reflexed. It is remarkable for having axillary buds on the stem. The bulbs are eaten in China and Japan.

TIGER-MOTH (*Arctia caja*). A genus of lepidopterous insects, the caterpillars of which are well known under the popular name of "woolly



Tiger Moth

bears." The moth is coloured red and brown. The larvæ feed on dead nettles. *See* MOTH.

TIGRIS. A river of Mesopotamia (Iraq), formed by the union of several streams near Diarbekr (East Kurdistan). It passes Diarbekr, Mosul, and Bagdad, and joins the Euphrates (q.v.) after a course of 1150 miles.

TIL, or **TIL-SEED.** The seed of the *Sesămum indicum* (*see* SESAMUM), also of *Guizotia oleifera*, a small plant belonging to the Compositæ, extensively cultivated in parts of India for the bland oil obtained from the seed.

TILBURG. A town and railway junction of the Netherlands, in the province of North Brabant. It has woollen factories, calico-printing, and other industries. Pop. (1932), 80,890.

TILBURY. An urban district of Essex, England, on the north bank of the Thames. It has great docks. Belonging to the Port of London, and enlarged since the Great War, these cover 676 acres, and accommodate the largest vessels afloat. Pop. (1931), 16,826.

TILIA'CEÆ. The lime tree family, a natural order of polypetalous dicotyledonous plants, consisting chiefly of trees or shrubs, with simple, toothed, alternate leaves, furnished with stipules. The species are generally diffused throughout the tropical and temperate parts of the globe. They have all a mucilaginous wholesome juice, and are remarkable for the toughness of the fibres of their inner bark, which is used for various economical purposes under the name of *bast*. Among the most important genera are Tilia and Corchorus, the former containing the common lime, the latter jute.

TILL. A name in Scotland for unstratified stony boulder-clays, and now extended by geologists to any similar superficial or drift deposit.

TILLAND'SIA. A genus of epiphytes, belonging to the nat ord. Bromeliaceæ, natives of tropical America. *T. amœna* and *T. splendens* are cultivated in hot-houses on account of the singular variety and splendour of the colours of their spathes and flower-spikes. *T. usneoides* is a native of the Southern United States, where it hangs in festoons from trees.

TILLER. *See* STEERING GEAR.

TILLETT, Benjamin. English Labour leader. He was born in Bristol in 1860 and after serving in the navy and the mercantile marine, settled at the London docks and organised the Dockers' Union. He was M.P. for N. Salford, 1917-24 and 1929-31, and chairman of the General Council of the Trade Union Congress, 1928-29, and published his *Memories and Reflections* in 1931.

TILLETIA. See *Bunt; Ustilagineæ*.

TILLICOULTRY (til-i-kö'tri). A burgh and manufacturing town of Clackmannanshire, Scotland, on the Devon. The manufacture of shawls, plaids, tartans, and tweeds, etc., is largely carried on. Pop. (1931), 2953.

TILLOTSON, John. English prelate, born in 1630, died in 1694. In 1647 he became a student of Clare Hall,

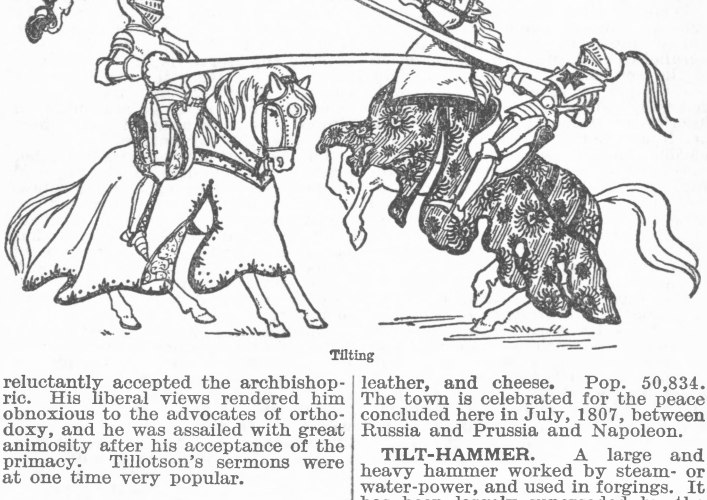
Cambridge, and he was elected a Fellow in 1651. He was a Presbyterian preacher until 1662, when he submitted to the Act of Uniformity, and was chosen preacher to the society of Lincoln's Inn, and lecturer at St. Lawrence, Jewry, in 1664. After becoming a D.D. in 1666, he was made king's chaplain, and presented to a prebend of Canterbury.

He was subsequently appointed Dean of Canterbury, and in 1689 he became Dean of St. Paul's. During the suspension of Archbishop Sancroft, Tillotson exercised the archiepiscopal jurisdiction, and in 1691 reluctantly accepted the archbishopric. His liberal views rendered him obnoxious to the advocates of orthodoxy, and he was assailed with great animosity after his acceptance of the primacy. Tillotson's sermons were at one time very popular.

TILLY, Johann Tserclaes, Count von. German soldier, born about 1559 at Tilly, in Walloon Brabant, died 30th April, 1632. After being educated by the Jesuits, he served successively in the Spanish, Austrian, and Bavarian armies. On the outbreak of the Thirty Years' War (q.v.) he led the army destined to crush the Protestants in Bohemia. He defeated them at the White Mountain (Nov., 1620), and in 1622 conquered the Palatinate, defeating several Protestant commanders. On 27th Aug., 1626, he defeated Christian IV. of Denmark in Brunswick, and compelled him to return to his own country.

In 1630 Tilly succeeded Wallenstein as generalissimo of the imperial troops. His most celebrated exploit is the sack of Magdeburg, 20th May, 1631. Gustavus Adolphus met him at Breitenfeld, near Leipzig (17th Sept., 1631), when Tilly was beaten, and was himself wounded. In a subsequent engagement with the Swedes on the Lech (15th April, 1632) a cannon-ball shattered his thigh, and caused his death.

TILSIT. A town of Germany in East Prussia, on the Memel. Manufactures include: iron castings, machinery, paper, cloth, soap, oils, leather, and cheese. Pop. 50,834. The town is celebrated for the peace concluded here in July, 1807, between Russia and Prussia and Napoleon.



Tilting

TILT-HAMMER. A large and heavy hammer worked by steam- or water-power, and used in forgings. It has been largely superseded by the steam-hammer, but is still advantageously used with light work.

TILTING. The leading item of the contests held at mediæval tournaments, consisted of combats between two or more opposing horsemen armed with lances, the points of which were sometimes, but not invariably blunted. Sir Walter Scott's description in *Ivanhoe* of the tournament at Ashby-de-la-Zouch affords a lifelike picture of the scene.

"Tilting at the quintain," so named from having early taken place in Roman camps in an open space between the fifth and sixth maniples, continued until the eighteenth century; the figure tilted at was usually

a Saracen, as typical of the natural enemy of all good Christians.

TIMARU. A seaport of South Island, New Zealand, 100 miles south of Christchurch. It has an excellent harbour, and exports wool, frozen meat, tallow, etc. Pop. (1932), 18,650.

TIMBER. Timber may be defined as wood utilised commercially. The term wood is usually held to mean those parts of the vegetable axis possessing a sufficient degree of hardness to be used for purposes where strength is required. Many plants possess woody stems; but bulk and dimensions are required in timber, and accordingly the greater portion of the woods used is derived from trees.

Wood, unlike steel is not homogeneous, but is made up of hollow fibres, most of which are placed parallel to each other in the direction of the vertical axis of the tree. The outer layer or sapwood in a tree is generally lighter in colour, and usually inferior as timber to the heartwood or inner portion, which is much harder and denser and darker in colour owing to the presence of substances with which it is impregnated.

Where knots or any abnormal growths occur, the fibres are usually found running in various directions, and any variation from straight grain has a deleterious effect on the strength of the wood.

The most common cause of decay in timber is the presence of moisture and the subjecting of the wood to alternating conditions of wetness and dryness, combined with heat and absence of ventilation. Consequently wood buried deep in the ground, placed under water, or kept absolutely dry will not decay. In all other situations timber is liable to decay unless treated with antiseptics or fungicides.

Commercial timber is divided into three main classes: *hardwoods*, *softwoods*, and *conifers*. Generally speaking, hardwoods thrive best in the warmer zones, while softwoods and conifers do well in the colder regions of the earth. Botanically the conifers are quite distinct from the other two groups, but commercially and technically these differences are only of importance in so far as they effect the utility of the wood.

The *physical properties* of timber are of great importance in estimating its value. Weight or density is dependent on the proportion of wood fibres to the other substances contained in the wood, and this will vary in different parts of a tree as well as in different species of trees. The only convenient standard of density is specific gravity, which varies according to the moisture in the wood. Moreover, the crushing strength and stiffness in a piece of wood increase approximately directly as the density. Some of the heaviest timbers are teak, boxwood, and ebony; spruce, Scots pine, and poplar are among the lightest.

The relation of wood to moisture is very important. Hardwoods have a lower water content than conifers, while sapwood has naturally a larger water percentage than heartwood. Moisture in wood affects very strongly the shrinkage, expansion, warping, and cracking of timber.

Irregularities in shrinkage cause wood to become warped, but careful seasoning or drying reduces this to a minimum. When the strains due to unequal shrinkage are too great for the strength of the timber, cracks are formed; and the more rapidly wood is dried the greater is the tendency to crack. A decrease in water content causes generally an increase in strength, but careless seasoning of timber may bring about defects which neutralise this advantage.

The *mechanical properties* of timber are largely dependent on the physical properties. The strength and hardness of timber are directly proportional to the weight. Defects usually decrease strength; but careful seasoning has beneficial effects. The *elasticity* of timber varies directly with its strength while flexibility and toughness are usually increased with the quantity of moisture.

Hardness in wood is rather an indefinite term, since it depends on the instrument used in cutting it. Ebony and lignum-vitæ are examples of the hardest, while spruce and poplar are amongst the softest of woods. *Durability* is of primary importance. Any timber placed in a situation favourable to the development of fungi will decay; but woods differ much in their resisting power. This depends mainly on the extent to which the wood is exposed to alternating changes from moisture to dryness, for fungi develop better under such conditions.

Woods such as conifers and softwoods, which are specially liable to attacks by insects or fungi, can be made of real commercial value by impregnation treatment. Many of the less resistant and lower priced species may be used in the place of more durable but more expensive species, if the former have been properly treated with creosote or some other preservative.

TIMBUKTU, or **TIMBUCTOO.** A city of the French Sudan, near the

southern edge of the Sahara, an important centre of trade 6 miles north from the main stream of the Niger. It mostly consists of adobe houses, but there are several mosques and a citadel. It depends chiefly on commerce, being a centre of traffic along the Niger, and is accessible from the coast by the Senegal-Niger Railway (Kayes-Koulikoro), 344 miles, and by steamer thereafter. Pop. 6118.

TIME. In music, is regarded from two quite different standpoints, and may refer either to the pace at which a composition is performed or to its rhythm as indicated by the notational value of the bar. It is unfortunate that such confusion should persist, but it is found in all countries, and there is little prospect that it will ever be removed. In English-speaking countries the difficulty might be solved by using the word *tempo* in the first case and *time* in the second.

Tempo, or pace, is a vital element in the success of any performance, and a wrong choice of tempo, if the error is sufficiently great, can alter entirely the character and meaning of a piece of music. Yet it was not till about the middle of the seventeenth century that composers began to provide tempo indications. At that period the art of instrumental composition was in its infancy, and the limited range of style and expression scarcely demanded that the composer should offer guidance as to rate of speed.

As the art advanced it became more and more the custom to indicate the required tempo, and Italy being the foremost country at that time in instrumental composition, it was natural that Italian terms should be used. They are still employed and understood universally, but in later times there is a growing tendency for composers to use the terms of their native tongue, a procedure that can be justified, though it has an obvious disadvantage.

Beethoven was one of the first to adopt this practice. In course of time the original significance of the more familiar of the Italian tempo-indications has slightly altered, the fast terms being taken faster and the slow terms slower. Thus, *allégro*, which was formerly used in the sense of "happy" or "lively," is now always understood to mean "quick," and the term "Allegro agitato" suggests nothing incongruous to the musical mind.

Time, in reference to notation and rhythm, is largely a technical matter, and does not call for detailed mention here. The reader may be referred to any of the numerous textbooks on rudiments of music. It is applied to all kinds of rhythmic combinations, and the particular one in immediate use is indicated by the time-signature, a vulgar fraction representing the proportion of a semibreve which is contained in each bar of the music.

There are two general classes of time, simple and compound, the unit of measurement in which is a simple note and a dotted note respectively. A feature of modern compositions is the constant changing of the time-signature. *See* STAFF.

TIME, SIDEREAL (Lat. *sidereus*, pertaining to the stars). So called because of its relation to the apparent diurnal motion of the stars, as opposed to solar time, which depends upon the sun. One rotation of the earth upon its axis does not take 24 hours of ordinary clock time, but is accomplished in 3 min. 55·9 sec. less. Therefore a star, after crossing the meridian, returns again to the meridian in 23 hr. 56 min. 4·1 sec. of ordinary time.

The sun takes the additional interval of nearly 4 minutes because of its apparent motion eastward relatively to the stars, which is due to the earth's annual revolution around it. It is of course convenient to the astronomer to keep a time which corresponds with the apparent motion of the stars, and he therefore has a sidereal clock, whose hour hand travels round the 24-hour dial in the sidereal day of about 4 minutes shorter than the solar day.

It is necessary to have a definite instant of commencement of the sidereal day, or a point of time at which the sidereal clock is to indicate 0 hr. 0 min. 0 sec. The instant is not defined by the passage of any arbitrarily selected star across the meridian, but by the passage across the meridian of the point of the celestial sphere known as the First Point of Aries. This is one of the two points at which the ecliptic, or sun's apparent annual path, crosses the celestial equator, and is the position which the sun occupies when crossing the equator at the spring equinox, on or about the 21st of March.

This point is very nearly, but not quite, fixed with reference to the stars. It has a very slow westward movement, in virtue of which it performs a revolution round the ecliptic in nearly 26,000 years (for explanation, *see* PRECESSION OF THE EQUINOXES). Neglecting this slight motion, each star crosses the meridian at a practically constant interval of time after the crossing of the First Point of Aries, and thus at a constant time on the sidereal clock.

The interval is the star's right

ascension, measured in time units. It will therefore be evident that, approximately speaking, whenever the sidereal clock at a given place shows a certain particular time, say 5 hr. 40 min., the aspect of the heavens will be always identical with all the stars in the same places.

Sidereal time is therefore useful when the observer wishes to point an equatorial telescope provided with setting circles at a celestial object whose co-ordinates, i.e. right ascension and declination, are known. He first sets the declination circle of the telescope to the object's declination. He consults the sidereal clock. If the time it indicates should be exactly the right ascension of the object, he knows the object will just be crossing the meridian. If it is different, the amount of the difference shows by what angle (*hour-angle*), eastward or westward as the case may be, the object is off the meridian.

The hour circle of the telescope is set accordingly, when the object will be in the field of the telescope. If the sidereal clock is precisely correct, or if its error is known, evidently the right ascension of a star can be found by noting at what time on the clock the star crosses the meridian. The instant of the star's crossing the meridian is obtained by observation with the transit circle (q.v.). Conversely, if a star's right ascension is known, observation of the time by the clock at which it crosses the meridian will give the error of the sidereal clock. Although sidereal time is useless for the ordinary purposes of life, mean solar time is practically always obtained by astronomers through the medium of sidereal time.

The transit of a star can be observed with great accuracy, whereas the sun is a most unsuitable object for a time observation. Navigators, who require to determine local time by the sextant to find the longitude, are mainly dependent on observation of the sun ; but for such purposes the time is required to be found correct only to a second or two, while in fixed observatories, with their large and stable instruments, it may be ascertained within a very small fraction of a second.

For determining sidereal time, stars which are near the celestial equator are more useful than those in higher declinations, because their apparent motion is more rapid. Convenient stars commonly used for the purpose are denominated *clock stars*. The method of observing the star's transit will be found in the article TRANSIT CIRCLE.

The star's right ascension must be accurately reduced to the date of the observation, by applying corrections in respect of parallax and proper motion (if either is appreciable), aberration, precession, and nutation. For the chief stars, the results are to be found in the *Nautical Almanac*. The difference between the star's right ascension and the observed time of its transit by the clock, each properly reduced, gives the error of the clock. The sidereal clock is always kept to the local sidereal time of the meridian of the observatory, while the mean time clock is kept to the time of the standard meridian of the country—in the case of British observatories, to Greenwich mean time.

The difference between Greenwich sidereal time and Edinburgh sidereal time is the same as the difference between Greenwich mean time and Edinburgh mean time ; in each case the Edinburgh time is the slower by an amount equal to the longitude of Edinburgh expressed in time (about 12 minutes 44 seconds).

Mean time of a place, as kept for astronomical purposes for many centuries back, always agreed with the sidereal time of the place once a year, about 22nd March. About 22nd Sept. it differed by 12 hours. But with the change introduced on 1st Jan., 1925, the mean time clock showing 0 hours at midnight instead of at noon, the coincidence of the times will occur always about 22nd Sept.

TIME, STANDARD. For regulating the ordinary affairs of life, a reckoning of time of day is adopted which is based primarily on the apparent daily motion of the sun. The instant of the sun's upper crossing of the meridian is called noon, and that of its lower crossing is called midnight. The day is considered to commence at midnight, and its two sections are each divided into 12 hours, distinguished as a.m. and p.m. Owing, however, to the varying length of the day (noon to noon), as indicated by the sun, a fictitious or *mean sun* is imagined to exist, which moves uniformly, and time is made to conform to its position (*see* EQUATION OF TIME).

All the places on one terrestrial meridian have noon (either apparent or mean noon) at the same instant, but places in different longitudes have different times, varying at the rate of 1 hour for every 15° of longitude, or 4 minutes for 1°. Before the introduction of railways, the disadvantages of diverse local times were not greatly felt, and most places kept the local time. When railway travelling became common, it was necessary for a uniform time to be used at all the

stations of a railway. Greenwich mean time was generally adopted by the railway companies in Great Britain, and gradually came to be used for most purposes of precision.

In 1880 the use of Greenwich mean time was legalised, and, though it was not made compulsory, its employment became practically universal. In 1916 and subsequent years, the "daylight saving" scheme was put into operation during a period of some months in the middle portion of the year. During that period the standard time was appointed to be 1 hour in advance of Greenwich mean time, which latter was regarded as normal time, while during the rest of the year normal time was to be kept (*see* SUMMER TIME ACT; DAYLIGHT SAVING).

It was then that for the first time Greenwich mean time was definitely prescribed by law to be the "time for general purposes," though for part of the year only. It was also provided that Greenwich mean time might continue to be used during the whole year for the purposes of astronomy, meteorology, and navigation.

During the latter part of the nineteenth century, it was usual for most of the chief countries to use a standard time, determined in each case by the meridian of the capital city. They also commonly used this meridian for the reckoning of longitudes. Owing, however, to the large merchant fleet and commerce of Britain, the Greenwich meridian was mainly used as prime meridian for all maritime purposes. Paris mean time is 9 minutes ahead of Greenwich, Berlin time 54 minutes, Rome time 50 minutes, etc.

Differences of such diverse amounts were found to be very inconvenient, and, as a result of international and astronomical conferences, standard times were introduced based on Greenwich mean time, differing from it by an integral number of hours, and using the same minutes, although in a few cases differing further by an odd half-hour. Thus most European countries now use as their normal time (1) Greenwich mean time; or (2) Mid-European time, one hour faster; or (3) East European time, two hours faster, whichever is the most accordant with their geographical position.

Most countries in other continents employ these or other "zone times" similarly based on the Greenwich meridian. Navigators had long been accustomed to use "ship time," altering their clocks each day to the local time of the longitude in which the ship was situated at noon.

But from about 1920 it has become the practice at sea also to use zone times, altering the clocks by an exact hour for each 15° of longitude, upon an average, that the ship has sailed eastward or westward. The minute hands of the clocks thus always show the Greenwich time minute.

It has sometimes been suggested that Greenwich mean time should be used everywhere throughout the world, thereby abolishing all other standard times. This, however, would have grave disadvantages. At many places each day and calendar date would begin at some hour during the daylight, allotting two parts of the same period of daylight to different days of the week and month. Or, if otherwise arranged, the day would require to begin not at zero time on the clock, but at some odd hour and minute.

It is true that one might soon get accustomed to calling the midday hour "7 o'clock," or anything else. But on travelling to any other longitude, he would find his habits of thought as regards time completely upset by the changed meaning of the hours of the day. The use of zone times preserves a sufficiently definite significance to the nomenclature of the hours to meet practical convenience.

Standard time is regularly determined at Greenwich and other observatories in this country, mainly by observation of the transit of stars, and is disseminated to the railways, post offices, etc., by electric current. Standard time is also sent out daily by wireless signals from certain stations on the Continent. These signals may be picked up by ships at sea, which can therefore now in many cases be practically independent of the chronometer.

TIMES, THE. A London journal which has long held the leading position among British newspapers; it was established in 1785 by John Walter, originally an underwriter at Lloyds, as *The Daily Universal Register*, the additional title of *The Times* being prefixed in 1788. The paper's early career was stormy; for in 1789 Walter suffered a sentence of fine and imprisonment for having published an article reflecting on the Duke of York. Paper and proprietor survived the punishment, and were far on the road to success when, in 1812, the first John Walter died.

Under his son and successor, John Walter the second, *The Times* advanced rapidly in power and importance. In 1814 steam was introduced as motive power to the printing-room, and this was only the first of a long series of mechanical improvements made in the production of the paper; in 1860 stereotype printing was

established, and nine years later the Walter press was perfected. The news-collecting and literary side of the journal more than kept pace with these advances.

Special attention had long been devoted to securing foreign news, and, as in the case of Waterloo, the paper frequently forestalled the Government in receiving early tidings of important over-sea events. In 1841 Thomas Barnes, after an editorship extending for a quarter of a century, was succeeded in the chair by John Delane, then only twenty-four; under his rule the paper gained the unofficial title of "The Thunderer" from the vigorous leaders supplied by Edward Sterling, father of the later famous John.

Later editors of distinction were Thomas Chenery, who succeeded Delane in 1877, and George Earle Buckle, who assumed the reins in 1884. Macaulay and Moore supplied *The Times* with poetry; Thackeray was a leading reviewer, besides contributing much original matter; while Brougham and Beaconsfield both wrote for its columns. In 1841 the paper's discovery and exposure of an elaborate and gigantic fraud upon bankers, which was being engineered from France, gave no small impetus to an ever-increasing success.

The exposure led to an action at law against *The Times*. Prominent London financiers raised a fund to pay the paper's costs; and this, being refused by the proprietor, was devoted to the foundation of scholarships at Oxford and Cambridge, and to the placing of commemorative tablets in *The Times* office and the Royal Exchange.

A further public service due to the energy and enterprise of the paper was the exposure of the gross mismanagement of the Crimean War, as set forth in the letters of its special correspondent, Dr. (later Sir) William Howard Russell. In 1887 *The Times* articles on "Parnellism and Crime" led to the establishment of the Parnell Commission and the exposure and suicide of the forger Piggott.

The third John Walter had succeeded as proprietor in 1847, his place being taken in 1894 by Arthur Walter. In 1908 the great newspaper became the property of a company, with the late Lord Northcliffe as financial chief. Lord Northcliffe's shares in *The Times*, as well as those of Sir John Ellerman, were acquired by Mr. John Walter in Oct., 1922, and Major the Hon. J. J. Astor was associated with Mr. Walter in their acquisition.

In 1895 the paper published *The Times Atlas*, which was shortly followed by a *Gazetteer*; later enterprises of a like nature were the production of an edition of the *Encyclopædia Britannica*, a reprint of the earlier volumes of *Punch*, a *History of the War in South Africa*, etc. *The Times* Book Club dates from 1905.—Cf. *The Times Centenary Number* (1888); E. T. Cook, *Delane of The Times* (1915).

TIMISOARA (formerly Temesvar). A city of Rumania, capital of the department of Timis, in a marshy plain in the Béga Canal. It is the seat of a Roman Catholic and Greek Orthodox Bishop, and has a Roman Catholic Cathedral built by Maria Theresa. Manufactures include tobacco, matches, leather, beers, etc. From 1552 to 1716 Timisoara was a Turkish town, and passed to Hungary, from which it was separated after the European War. Pop. (1930), 91,866.

TIMO'LEON. Greek general, liberator of Sicily from the dominion of Dionysius the Younger, born at Corinth about 411 B.C., died 337 B.C. He was passively involved in the assassination of his brother Timophanes, who wished to usurp the supreme power, and spent twenty years in voluntary exile.

On the invitation of his fellow-citizens he returned and took command of the troops sent to Sicily to aid the Syracusans against Dionysius the Younger and the Carthaginians (344 B.C.). He expelled Dionysius from Syracuse (343 B.C.), and totally routed the Carthaginians (339 B.C.). Having restored their liberty to the Syracusans, and recalled the exiles and fugitives, he gave the citizens a new and more stable constitution, and finally, having accomplished his mission, voluntarily laid down his power and retired into private life. All Sicily mourned his death, and he was buried at the expense of the city.

TIMOR. The most easterly of the Sunda Islands, Malay Archipelago, politically divided between the Netherlands and Portugal. **Physical.**—It is traversed from east to west by rugged limestone mountains (6000-7000 feet average altitude) running parallel to the coral-fringed coast-line, and furrowed by the valleys of short, turbulent streams. The flat coastal plains are humid and malarial, and the mean daily temperature is from 80° to 100° F. Above the 2000-3000 feet level, however, anopheline mosquitoes disappear (at least in the Portuguese area), and malaria is replaced by hill diarrhœa. There are two seasons: (1) wet (November-April), and (2) dry (May-November). Dutch Timor possesses many mud volcanoes. **Political.**—The divisions are as follows:

(1) **Dutch Timor,** the western half of the island, excluding the enclave of Ocussi (Portuguese) on the north coast. There is a coast-line of 450 miles broken by Kœpang Bay, upon which stands the port of Kœpang. Tetum in the east, Dawan in the west, and Malay in Kœpang are the chief languages; the people (pagan) are mainly Timorese, Belonese, and Kœpangs (also found in Samau Island, where their rajah is located). Kœpang is the administrative centre of Timor Archipelago (24,530 sq. miles; pop. (1930), 1,656,636). **Production.**—Maize is the native staple; rice, wheat and millet, sago, coco-nut palms, tobacco, onions, vegetables, and fruit are raised. Small horses are exported, with honey and wax, etc. Area, 5020 sq. miles; pop. (very doubtful), 350,000.

(2) **Portuguese Timor,** the eastern half of the island, including the enclave of Ocussi (950 sq. miles) and Kambing Island (55 sq. miles); total area, 7330 sq. miles; pop. 451,604. There is a coast-line of 500 miles; the Ocussi seaboard is 35 miles long. The natives are mainly pagan Belonese; but there are also Arabs, Chinese, and Portuguese. Tetum is the *lingua franca.* Dili (Dilly) is the capital and chief port (pop. 4000). **Production.**—Coffee is the greatest export, with sandalwood second and copra third. Skins and hides, buffaloes, bees-wax (from hordes of wild bees), cocoa, and horn are also exported. Rice, alcohol, and textiles are the chief imports. *See* MALAYA (section *Malay Archipelago*); SUNDA ISLANDS.

TIMORLAUT, or **TENIMBER ISLANDS.** A Dutch group of islands of the Malay Archipelago. The largest, Timorlaut or Yamdena, is about 75 miles long (1100 sq. miles in area). Selaru (299 sq. miles) and Larat (199 sq. miles; pop. 2000) with thirteen smaller islands complete the group (area, 2096 sq. miles), which belongs to the Residency of Amboyna. The islands are low and calcareous. Products include maize, fruit, potatoes, palm-oil, and trepang. Pop. 24,858.

TIMOTHY (Timotheus). The name, in the New Testament, of a younger colleague of St. Paul. He was the son of a mixed marriage; his Jewish mother had married a pagan. Consequently, although he received a religious training, he was not circumcised. The Apostle converted him at Lystra, a Roman colony in Lycaonia, and enlisted him in the mission.

To facilitate his efforts among Jews, Paul had him circumcised. Joining Paul and Silvanus, he took an active part in the first mission to Europe; with the Macedonian Churches, and especially with that at Thessalonica, he had close relation, acting as Paul's deputy (see THESSALONIANS, EPISTLES TO). Two years after the party left Corinth for Asia, Timotheus worked there, and was employed by Paul in communicating with the Church at Corinth. He accompanied Paul to Corinth on his final visit, but apparently not on his voyage to Rome, though he joined Paul there later. We may infer from Acts, xx., 4-5, and from the tradition underlying the epistles to Timothy, that he was put in charge of the Christians in and around Ephesus, with semi-episcopal powers. An enigmatic allusion in Heb., xiii., 23 throws no clear light upon his movements, for " our brother Timothy is set at liberty " may mean " our brother Timothy is now free ;" it does not necessarily imply imprisonment. Besides, no one knows who wrote Hebrews or to whom it was written.

His character shows a warm loyalty to Paul. He was evidently a trustworthy, capable agent of the Church. But there was a vein of backwardness in him, a shrinking from responsibility, and even a tendency to timidity, against which his senior warns him.

All that is known of him is preserved in Acts, xvi., 1-3; xvii., 14-15; xviii., 5; xix., 22; xx., 4-5; and the references in Paul's epistles (1 Thess., i., 1; iii., 2, 6; 2 Thess., i., 1; 1 Cor., iv., 17; xvi., 10; 2 Cor., i., 1, 19; Phil., i., 1; Col., i., 1; Philem., i.; and the pastoral epistles).

TIMOTHY, EPISTLES TO. Two books of the New Testament attributed to St. Paul. These epistles, along with that to Titus, are called the pastoral epistles, as to the genuineness of which there has been considerable controversy. By the early Christian Fathers they were almost universally accepted as genuine, and their genuineness is also supported by external testimony. They were, however, rejected by Marcion, Basilides, and other Gnostic heretics. In modern times both views have been ably advocated. Their genuineness is chiefly attacked on the grounds that their style differs from that of the acknowledged epistles of St. Paul, that the heresies alluded to in the epistles betray a later age, that the ecclesiastical polity of the epistles is too complete to belong to the time of the Apostles, and that it is difficult to find any part of the Apostle's life to which they can be assigned. Biblical critics generally meet the last difficulty by assigning them to a period after the close of the narrative

in the Acts, the second epistle to Timothy being written while St. Paul was undergoing a second imprisonment in Rome.

TIMOTHY-GRASS (*Phleum pratense*). A hard coarse grass with cylindrical spikes from 2 to 6 inches long. It is used mixed with other grasses for permanent pasture, and grows best in tenacious soils. It is extensively cultivated throughout Great Britain, and also in North America. Timothy Hanson first recommended it, hence its name.

TIMUR, TIMUR BEG, TIMUR LENK (that is, *Timur the Lame*), or **TAMERLANE.** Mongol conqueror, born in the territory of Kesh, near Samarkand, in 1336, died in 1405. His ancestors were chiefs of the district, and Timur by his energy and abilities raised himself to be ruler of all Turkestan (1370). By degrees he conquered Persia and the whole of Central Asia, and extended his power from the great Wall of China to Moscow. He conquered India (1398) from the Indus to the Ganges delta, and on his way from India to meet the forces of Bajazet, the Turkish Sultan, he subjugated Bagdad, plundered Aleppo, burned down the greater part of Damascus, and wrested Syria from the Mamelukes, after which he overran Asia Minor with an immense army. Bajazet's army was completely defeated on the plain of Ancyra (Angora) in 1402, and the Sultan was taken prisoner. The conquests of the Tatar now extended from the Irtysh and Volga to the Persian Gulf, and from the Ganges to the Grecian Archipelago. He was making mighty preparations for an invasion of China when death arrested his progress at his camp at Otrar, beyond the Syr-Darya, and his empire immediately fell to pieces. He was fanatical in his religion, but in a measure a patron of science and art, and he is also the reputed author of the *Institutions of Timur* and the *Autobiography of Timur*, both translated into English. Timur is known in literature through Marlowe's drama *Tamburlaine the Great.*

TIN. A soft, white, ductile metal; atomic weight 118·7; chemical symbol, Sn (from Lat. *stannum*). It has been shown by Aston to be a complex element, consisting of 7 or 8 isotopes (q.v.). Tin appears to have been known in the time of Moses; and the Phœnicians traded largely in the tin ores of Cornwall. The mountains between Galicia and Portugal, and those separating Saxony and Bohemia, were also productive of tin centuries ago, and still continue unexhausted.

Tin occurs in the Malay Peninsula, the Island of Banca, India, Mexico, Chile, Peru, the United States, Australia, etc. There are only two ores of tin: the native dioxide, called *tinstone* or *cassiterite*; and the double sulphide of tin and copper, called *tin-pyrites*. The former is the only ore used for obtaining metallic tin in quantity.

It occurs either in the massive form or as distinct quadratic crystals which have a dark-brown colour and metallic lustre. It is usually contaminated with sulphide of copper, arsenical pyrites, and tungsten compounds. It is found in veins in metamorphic or igneous rocks, such as granite, porphyry, slate, etc., and is then known as *mine-tin*, or sometimes in alluvial deposits formed by the denudation of the above veins, and is then known as *stream tin.*

The ore is first ground and washed, and then roasted in a reverberatory furnace to expel the sulphur and arsenic. Mixed with limestone and fuel, it is again fused in a furnace for about eight hours, the earthy matters forming a slag with the lime, while the oxide of tin, reduced to a metallic state, falls by its own weight to the bottom, and is drawn off. The tin, still impure, is again moderately heated, when it melts and flows off into the refining basins, leaving the greater part of the foreign metals in a solid state. The molten tin is further refined by stirring with a wooden pole, or by "tossing," and is cast into blocks and sold as *block-tin*, the purest specimens being called *refined-tin.*

Pure tin has a fine white colour like silver. It has a slightly disagreeable taste, and emits a peculiar sound when bent, known as the "cry" of tin. Its hardness is between that of gold and lead, and it is very malleable. Specific gravity, 7·29; melting-point, about 232° C.

It loses its lustre when exposed to the air. At very low temperatures it passes spontaneously into another modification known as *grey-tin*; this has a specific gravity 5·8, and falls to a powder.

Ordinary tin can be rolled out into very thin sheets known as *tin-foil.* Oxygen combines with tin, forming protoxide of tin or *stannous oxide* (SnO), and dioxide or *stannic oxide* (SnO_2). The compounds of chlorine with tin are dichloride or *stannous chloride* ($SnCl_2$), and *stannic chloride* ($SnCl_4$). Stannic chloride has long been known as *the fuming liquor of Libavius*, so called from Libavius, a chemist of the sixteenth century. *Stannic sulphide* (SnS_2) has long been known in chemistry as *aurum mosaicum* or *mosaic gold.*

Tin unites with arsenic and with

antimony, but not readily with iron. Alloyed with copper it forms bronze, bell-metal, and several other useful alloys. With lead it forms pewter and solders of various kinds. Its oxides are used in enamelling and for polishing metals, and its solution in muriatic acid is an important mordant in dyeing, rendering several colours, particularly scarlet, more brilliant and permanent. *See* TIN-PLATE.

TIN'AMOU. South American birds of the family Tinamidæ, somewhat resembling a partridge, and varying in size from that of a pheasant down to that of a quail. They are more nearly allied to the ostrich, etc. (Ratitæ), than are other flying birds. Typical genera are Tinamus (ten species), Crypturus (at least thirty species), and Rhynchotus (two species). To the last belongs the great tinamou (*R. rufescens*), which is about 18 inches long, and inhabits the forests of South America.

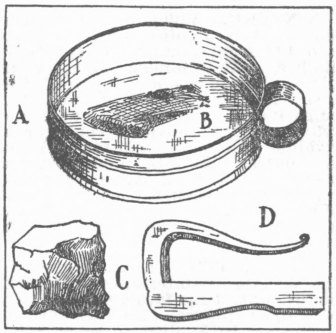
TIN'DAL, Matthew. English deist, born about 1653, died in 1733. He entered Lincoln College, Oxford, in 1672, and became a Fellow of All Souls in 1678. After the Revolution he sat as a judge in the Court of Delegates. In 1706 he published a treatise entitled the *Rights of the Christian Church*, attacking hierarchical supremacy. This work excited the animosity of the High Church clergy, and the House of Commons ordered it, together with two defences of it written by Tindal, to be burned by the common hangman.

In 1730 he published his most famous work, *Christianity as Old as the Creation, or the Gospel a Republication of the Religion of Nature*, in which he maintains that there has been no revelation distinct from the internal revelation of the law of nature in the hearts of mankind.—Cf. Sir Leslie Stephen, *History of English Thought in the Eighteenth Century*.

TINDER. Any highly inflammable material readily ignited (without explosion) from a spark, and employed as a means for kindling a fire in days preceding the invention of lucifer matches. The tinder, made of charred linen, touch-wood, decaying wood, or touch-paper, was ignited by means of sparks produced by striking flint against steel, the whole apparatus, tinder, flint, and steel, being contained in a metal box termed a tinder-box.

TINNEVELLY. A maritime district and town of the Madras Presidency, India. The district faces the sea on east and south, and the Western Ghâts on the west, and is traversed by the Tambraparni River (70 miles), emptying to the Gulf of Manaar. Rice and rági are the staple food-grains. 23 per cent of the people live in towns. The town is the largest in the district, and stands on the Tambraparni opposite Palamcottah (the district headquarters; pop. 40,000). It is on the South Indian Railway. Area (district), 4325 sq. miles; pop. 1,901,396; pop. (town), 53,783.

TINOS, or TENOS. An island in the Grecian Archipelago, one of the Cyclades, immediately south-east of Andros; area, about 85 sq. miles. It produces barley, silk, wine, figs, oranges, and honey; and black, white, and green marble is worked by an English company. Tenos, or St. Nicolas, and Port Panormos are the chief harbours. Pop. (island), 12,000; (town), 3000.



A, Tinder-box with B, Tinder.
C, Flint. D, Steel.

TIN-PLATE. Tin-plate consists of thin sheets of mild steel covered with a very thin coating of tin, and is very largely used for the manufacture of vessels used in the canning of fruit, milk, meat, etc. It is also used for the storage vessels used for petrol, biscuits, and tobacco. The manufacture of tin-plate is one of the most important industries of South Wales, and large quantities are also produced in Germany and the United States.

In order that the tin may act as an efficient protector against oxidation and rusting, it is absolutely necessary that the metal shall completely cover the surface of the steel, and if this be not the case, for example, if pinholes uncovered by tin be present on the surface, then the tendency for rusting to commence at these points is actually greater than in the case of steel unprotected by tin, owing to the fact that round about these uncovered spots the iron and tin will form an electrolytic couple in the presence of moisture, in which the

iron will act as the anode and will tend to pass into solution in preference to the tin. For the manufacture of tin-plate, mild steel containing about 0·1 per cent of carbon is first rolled into very thin sheets. These sheets are then pickled to remove scale from the surface, then annealed, cold rolled, and again annealed. They are again pickled in acid, as the complete removal of oxide is most important. They are then fed automatically through a bath of molten tin, protected from oxidation by means of a layer of zinc chloride, then through a layer of palm-oil and through a pair of rolls for the removal of excess tin. They are then cleaned by a machine using bran or a mixture of gypsum and sawdust, and are polished with sheepskins.

TINTERN. Village of Monmouthshire. It is 5 miles from Chepstow and 138 from London, on the G.W. Railway. It is famous for the ruins of its abbey, once one of the wealthiest Cistercian houses in England. The ruins include the chapter house and refectory, but above all the church, rivalling in size the minster at York. In 1900 the Duke of Beaufort presented the estate to the nation, and extensive repairs have been carried out. The abbey stands by the Wye in a landscape of almost unique beauty. Pop. (1931), 650.

TINTORETTO. The name given to the Venetian painter Jacopo Robusti on account of his father's trade, that of a dyer (*tintore*). He was born at Venice in 1518, died there in 1594. He studied for a few days under Titian, but, being dismissed without explanation by his master, he afterwards pursued his studies alone, and endeavoured, in his own words, to unite Titian's colouring with the drawing of Michelangelo. He is almost alone among the great Venetian painters of his generation in never leaving Venice, save for a short visit in his old age to Mantua to place in position some battle-pieces he had painted for the duke. He was chiefly employed by the citizens, the churches, the fraternities, and the Government of Venice, one of his first important commissions being from the Scuola di San Marco in 1547, for which he produced a series dealing with the miracles of St. Mark. In 1559 he began the decoration of the scuola and church of San Rocco, where still remains one of the most representative collections of his work, including a famous *Crucifixion*, completed in 1565. In 1561 came his first commission from the State, for which he produced an elaborate series of decorations in the Ducal Palace, in which the *Paradise* (finished about 1584) represents the culmination of his art. Other notable works are: the *Marriage of Cana* (1561, Salute Church, Venice); *The Last Judgment* (S. Maria dell' Orto); *The Last Supper* and *Gathering of the Manna* (S. Giorgio Maggiore); and a series dealing with the life of S. Catherine in the church dedicated to that saint. He also painted a remarkable group of portraits, unequal in quality, but the best of them marked by rich sombre tone and penetration into character. His earlier work shows markedly the influence of Titian in its colour and use of light and shade, and of Michelangelo in the treatment of form. Later, while Michelangelo still influenced his draughtsmanship, his colour became cooler, and he developed the use of light and shade to give silhouetted forms, whence he builds up his designs. His facility was immense, and sometimes led to empty and mechanical handling. But his best work has proved a most potent influence in later art. Outside Venice, good work by him is rare; but the National Gallery has two fine and characteristic examples.

TINWORTH, George. English artist in terra-cotta, born in Walworth, 5th Nov., 1843; he studied sculpture, and in 1867 joined Doulton's pottery works in Lambeth, staying there till his death on 10th Sept., 1913. He excelled in terra-cotta reliefs, exhibiting at the Royal Academy for many years. In collaboration with Street, the architect, he executed a large panel of the Crucifixion for York Minster, as well as 28 panels for the Guards' Chapel in St. James's Park.

TIP'PERA. A district of India, in the Chittagong division of Bengal. It is an alluvial plain, and the chief river is the Meghna. There are three harvests, rice, jute, oil-seeds and food-crops being grown. The Assam-Bengal Railway traverses the district. Comilla (the headquarters), Brahmanbaria, and Chandpur are the chief towns. Area, 2499 sq. miles; pop. 2,430,000.

TIPPERA'RY. An inland county, Irish Free State, in Munster; area, 1661 sq. miles. The principal mountain groups are the Knockmealdown, the Galtees, and the Keeper and Devil's Bit Mountains, the greatest elevation being 3000 feet. The chief crops are oats, potatoes, and wheat. The level country forms part of the great central plain of Ireland, and includes some branches of the Bog of Allen.

Mineral products include coal, copper, zinc, and argentiferous lead;

slates of good quality are extensively raised near Killaloe. Grazing is the principal employment, and there are numerous dairies. Chief towns: Clonmel, Carrick-on-Suir, Nenagh, Thurles, Cashel, Tipperary, and Roscrea. Pop. (1926), 140,946.

TIPPERARY. The county town of Tipperary County, Irish Free State, on the Arra. It has an endowed grammar-school, a convent, a butter market, and a corn and provision market. The chief trade is in butter. Pop. (1926), 5554.

TIPPOO SAHIB. Sultan of Mysore, son of Hyder Ali (q.v.), born in 1749, died in 1799. He succeeded his father in 1782, and continued the war with the British in which his father had been engaged, but in 1784 was induced to sign the Treaty of Mangalore on advantageous terms.

In 1789 he attacked the Rajah of Travancore, an ally of the British, which occasioned the second Mysore War. An offensive and defensive alliance was concluded (June, 1790) between the East India Company, the Peishwa of the Mahrattas, and the Nizam. In the campaign of 1790 and 1791 several places were reduced by the allies, and Tippoo was finally besieged in his capital, Seringapatam.

He was compelled to cede half of his dominions, but hostilities broke out again in 1799. Tippoo was defeated in two battles, and retreated to Seringapatam. On 4th May, General Baird reduced the place by storm, and Tippoo perished in the assault.

TIPTON. An urban district of Staffordshire, England, near Dudley. It depends chiefly on its manufactures of heavy iron goods. Pop. (1931), 35,792.

TIP'ULA. A genus of dipterous insects or flies, of which the common crane-fly or daddy-long-legs (*T. oleracea*) is a typical species. *See* CRANE-FLY.

TIRAH. A mountainous region of the North-West Frontier Province of India, comprising the area watered by the Khanki Toi, Khurmana, and Mastura Rivers. In their upper courses the valleys (5000-7000 feet altitude) afford a summer pasturage, but are snow-bound in winter, when the climate is intensely cold. Nomadic Afridi tribes people Tirah for a part of each year.

TIRANA. The capital of Albania, in the valley of the Rushka. Viticulture is practised. Pop. (1930), 30,806.

TIRASPOL. A town of the Ukraine, in the former Russian government of Kherson, near the Dniester and on the Odessa-Kishinev Railway. Tobaccos are manufactured. Pop. 35,240.

TIRCONAILL. The Irish name of Donegal (q.v.).

TIREE'. An island of the Inner Hebrides, Scotland, in Argyllshire. It is about 14 miles long, and reaches 6 miles in breadth, is generally low and flat, but has several heights of 400 feet. Agriculture and fishing are the leading industries. Tiree is treeless, and is noted for its snipe. Skerryvore lighthouse is within the parish. Pop. (1931), 1451.

TIRLEMONT (tirl-mŏn). A town of Belgium, in Brabant. It has manufactures of woollens, brewing and tanning industries, and a grain trade. Pop. 19,000.

TIROL, or TYROL. A province of the Republic of Austria, comprising Tirol proper and the detached district of Lienz. Tirol is divided into seven districts and the city of Innsbruck. Innsbruck is the capital. Area, 4882 sq. miles; pop. (1923), 313,885 (about 60 per cent German-speaking Roman Catholics).

Physically the region is mountainous, traversed by the Lechtaler Alps, Stubaier Alps, Kitzbühler Alps, Otztaler Alps, and the northern slopes of the Zillertaler Alps, and drained to the Danube by the Inn. Agriculture and stock-raising are progressive, and about 40 per cent of the region is forest. The ancient mines of Tirol are now relatively unimportant, and manufactures are insignificant.

The real wealth of the country lies in its scenery and its position as custodian of the principal routes from Germany into the Trentino. Innsbruck is the centre of the railway system, which comprises: (1) an eastern line running via Jenbach (pop. 2281; an iron-smelting town) and Wörgl (pop. 4000; for Salzburg, 120 miles, via Kitzbühel, which is noted for its mineral spring and the working of copper and iron; pop. 2500) along the Lower Inn Valley to Kufstein (pop. 6662) for Munich. Innsbruck to Kufstein is 48¼ miles.

(2) A southern line runs via Steinach (pop. 2000) and the Wipp Valley to Brenner (pop. 461), where there are two tepid mineral springs. From Brenner the line is continued through the Trentino (q.v.). (3) The western line follows for a time the Upper Inn Valley and reaches St. Anton and the Arlberg Tunnel (*see* ALPS), 68 miles from Innsbruck. All the towns mentioned stand high, and for this reason the climate is generally cold, e.g. the mean annual temperature at Innsbruck is 48° F. Hall (q.v.) is a salt-manufacturing town.

Mineral operations have been confined for centuries to the Inn Basin, especially centring on Schwaz (pop. 8000) and Rattenberg (pop. 1000).

Electrification. The railway north from Innsbruck is now electrified, and connects at Mittenwald with the South Bavarian electric system. The lines from Tirol to Italy and from Innsbruck to St. Anton (for Switzerland) are also electrified. Further water-power resources are estimated at 320,000 h.p., or, with Vorarlberg, 380,000 h.p. Over 43,000 h.p. additional have been put into service, and many schemes are afoot for the further development of Tirolean water-power to increase the power generated to 333,000 h.p. Among these, the Achensee project, devoted to the exploitation of the largest lake in Tirol, is planned to give a total generated power of 134,000 h.p. (according to Quigley), "destined to supply the whole of Northern Tirol with light and power and contribute to the further electrification of the Austrian Federal Railways."

Lienz. The district is subdivided into the districts of Lienz, Windischmatrei, and Sillian, and has a population of 40,000 to 50,000 (German-speaking Roman Catholics mainly). Windischmatrei (pop. 900) and Sillian (pop. 700) are market towns, the latter having baths at Weitlandbrunn in the vicinity. Lienz town is the ancient *Aguontum Noricum*, and is the administrative centre of the district. It is a summer-resort and a centre for sight-seeing in the Tauern and the Dolomites. There are baths at Leopoldsruhe and Jungbrunn. Communication is made at Franzensfeste (Fortezzo) with the Brenner line (*see* TRENTINO), running via Innichen (frontier), Sillian, and the Drava Valley (i.e. along the Pustertal) to Lienz, whence the line is continued to Villach. Innichen to Lienz is 26 miles.

TIRPITZ, Alfred von. German admiral, born 1849, died 1930. He entered the Prussian navy as a cadet (1865), and became Chief of Naval Staff in 1892. From June, 1897, till March, 1916, when he retired on account of a conflict of interests with Bethmann-Hollweg, Tirpitz was Naval Secretary (afterwards Minister) of State, and it was to him that the naval might of Germany was really due. His object has been disputed, but his own views are to be found in his *Erinnerungen*, published during 1919. Tirpitz was ennobled in 1900.

Early in the European War Tirpitz had advocated that the German Fleet engage in battle, and he soon recognised how important and potent a factor the U-boat campaign would prove to be. He helped to found the Vaterlandspartei, the "no peace by compromise party." In 1921 he entered the Reichstag as German National Deputy. In 1924 he published *Politische Dokumente*.

TI'RYNS. A very ancient ruined city of Greece, in the Peloponnesus, in the plain of Argolis, about 3 miles from the sea. The foundation of the city was ascribed to Prœtus, and in 468 B.C. it was destroyed by the Argives. There are the remains of Cyclopean walls, and of a palace of the eleventh or tenth century B.C., excavated by Schliemann in 1884-5.

TISA. *See* THEISS.

TISCHENDORF (tish'en-dorf), **Lobegott Friedrich Konstantin.** German Biblical critic, born in 1815, died in 1874. He studied at Leipzig, and in 1859 became professor of theology. He made several visits to the East, and brought back valuable MSS., the most remarkable being (in 1859) the *Codex Sinaiticus* (*see* CODEX). Tischendorf was continually engaged in editorial labours, and was broken down by overwork in 1873.

TISSUES. (1) In animal anatomy, the texture or grouping of anatomical elements of which the systems of organs are composed. Thus in special histology we speak of *muscular tissue*, or flesh; *osseous tissue*, or bone; *adipose tissue*, or fat; *cartilaginous tissue*, or gristle; *pigmentary tissue*, or colouring-matter seen in the skin, etc.; *areolar*, *cellular*, or *connective tissue*, widely distributed in every part of the body, and serving to bind together and consolidate other parts and tissues.

(2) In botany, tissues of plants are conveniently classified according to the purposes which they serve. The principal forms are: (*a*) *vascular* or *conducting tissues* (q.v.), largely made up of tubular structures. (*b*) *Mechanical* or *supporting tissues*, which are mainly responsible for the mechanical strength of roots and shoots; they consist typically of long, pointed, thick-walled cells (*fibres*). (*c*) *Protective tissues*, including *epidermis*, *cork*, etc. (*d*) *Absorbing tissues*, of which the piliferous layer of roots is the type. (*e*) *Parenchyma*, composed of rounded, oblong, or polyhedral cells, and concerned with a variety of functions, such as carbon-assimilation, storage, etc. *See* BOTANY. — Cf. G. Haberlandt, *Physiological Plant-anatomy*.

TISZA, Koloman. Hungarian statesman, born 1830, died 1902. He entered the Hungarian Parliament in 1861, founded a Liberal party of

advanced views, and was Prime Minister from 1875 to 1890. During his term of office he attempted the Magyarisation of Transylvania, but opposed the occupation of Bosnia and Herzegovina.

TISZA, Stephen (Hung. *Istvan*), **Count.** Hungarian statesman, born 1861, died 1918. A son of the preceding, he entered the Hungarian Parliament in 1886, and came rapidly to the front as an expert on the land question, which his *Magyar Agrarpolitik* dealt with authoritatively, and he took also a leading part in educational and financial problems. He was Prime Minister from 1903 to 1905, governing, or attempting to govern, under impossible conditions of obstruction which amounted almost to anarchy, and in 1905 his appeal to the country was rejected, and he retired.

In 1913 he again assumed the premiership, and, with Count Berchtold, he framed the terrible Serbian ultimatum of 1914. His truce with the Opposition lasted until 1917, when he again resigned, and was assassinated on 31st Oct., 1918. Tisza was probably the greatest minister the Dual Monarchy ever possessed, and his power was certainly exceeded by none.

TITANIUM. An element discovered in 1791. Symbol, Ti; atomic weight, 48·1. It is found combined with oxygen in several minerals, and especially in iron ores, known as titaniferous iron ores. It is a dark-grey, very heavy, amorphous powder, in many respects resembling silicon. Its oxide forms the minerals *rutile*, *anatase*, and *brookite*. The ores include *menachanite*, from Menachan in Cornwall, where it was originally found; *iserine*, from the River Iser in Silesia; etc.

TITANS. In Greek mythology, the sons and daughters of Urânus (Heaven) and Gê (Earth). They were twelve in number, six sons and six daughters. They rose against Urânus and deposed him, raising Cronus, one of their number, to the throne. They were afterwards overcome by Zeus, and thrown into Tartarus.

TITHE (A.S. *teotha*, one-tenth). The tenth part of the produce of land allotted to the maintenance of the clergy and other ecclesiastical purposes. The gift of Abraham to Melchisedec is the earliest instance on record of the payment of tithes ("He gave him tithes of all," Gen., xiv., 20); the vow of Jacob at Bethel is the second ("Of all that thou shalt give me I will surely give the tenth unto thee," Gen., xxviii., 22). The payment of tithes was enjoined by the law of Moses, but was not adopted by the early Christian Church, which depended upon the freewill offerings of its adherents. By the end of the fourth century, however, we find the obligation of tithe-giving firmly established as a religious duty, though some centuries were yet to pass before it received, in England, the recognition of the State. That further step was taken in 970, when the laws of Edgar enacted penalties for the non-payment of tithes. There was now a civil as well as a religious sanction. Tithes were originally distinguished as "prædial," or the produce of land; "personal," or the profits of the arts and crafts; and "mixed," or the produce of live-stock; but all distinctions were rendered obsolete by the Tithe Commutation Act, 1836, which provided for an annual money payment or tithe-rent charge based upon a fixed valuation, but varying with the average price of corn over a period of seven years. The liability may be redeemed by arrangement with the Board of Agriculture. In 1913 £100 of tithe-rent charge was worth £74, 14*s.* 9¾*d.* It rose in value each year until 1918, when it was fixed for seven years at £109, 3*s.* 11*d.* Since 1925 it has been based on the average prices for the preceding fifteen years.

TITHING. An ancient subdivision of England, forming part of the hundred, and consisting of ten householders and their families held together in a society (all being bound for the peaceable behaviour of each other) the chief of whom was the *tithing-man*.

TITHO'NUS. In Greek mythology, a son, or brother, of Laomedon, King of Troy. He was beloved by Eos (Aurora, Morning), who importuned Zeus to make him immortal. Her prayer was granted, but she had neglected to ask for continual youth, and in time her lover took on all the signs of extreme age. Tithonus's prayer to the gods to be relieved of the burden of old age was answered by his being metamorphosed into a grasshopper.

TITIAN (tish'i-an), or **TIZIANO VECELLIO** (tit-si-a'no). Venetian painter, born 1477, died 1576. He studied under Giovanni Bellini of Venice, and came under the influence of Giorgione, with whom he was associated in executing the frescoes on the Fondaco dei Tedeschi, which have now almost completely disappeared. Typical of this period are *Sacred and Profane Love* (Borghese Gallery, Rome), and the *Madonna of the Cherries* (Vienna).

In 1511 he was invited to Padua,

where he executed three frescoes in the Scuola del Santo; and in 1516 made his first recorded visit to the court of the Duke of Ferrara, for whom he painted the *Worship of Venus* and a *Bacchanal* (now in the Prado), a number of portraits, and (in 1523) *Bacchus and Ariadne* (National Gallery). In 1516 also he was commissioned by the State to paint a battle-piece in the Ducal Palace; but the picture was not completed until 1557, and was destroyed by fire in 1577.

All this early work shows strongly the influence of Giorgione in its pagan joyousness and rich glowing colour. The famous *Assumption of the Virgin* (Venice Academy) marks the emergence of an independent art, one characterised by great opulence and splendour, but sensuous and materialistic. Characteristic are the *Pesaro Madonna* (Frari, Venice); *The Presentation of the Virgin* (Venice Academy); *Death of St. Peter, Martyr* (destroyed by fire in 1867); and an important group of portraits.

No painter was ever more sought after than Titian, and among his friends and patrons were all the principal personages of the day, including Federigo Gonzaga of Mantua and the Emperor Charles V. It was probably in 1533 that Titian first painted the latter, and thenceforward he was constantly employed by the imperial family and court, for whom the important group of his works in the Prado (including *Danae*, *The Fall of Man*, and portraits of Charles V. and Philip II.) was painted.

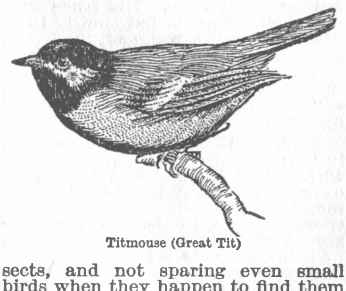
In 1545 he visited Rome, where he painted the group of Pope Paul III., the Cardinal Farnese, and Duke Ottavio Farnese. His last period begins about 1555, and in one group of work (such as *Perseus and Andromeda* in the Wallace Collection) Titian recaptures the spirits of pagan poetry which fills his earlier work; while in another, represented by *Christ crowned with Thorns* (Munich), he displays a new depth and quality of emotion.

In this period also he abandoned the use of rich local colour for a treatment in which it is modified by the play of light and shade and by atmosphere; and thus led the way to the use of chiaroscuro characteristic of the seventeenth century. Of Titian's private life but little is known. He died of the plague in 1576, aged ninety-nine, having painted to the last with almost undiminished powers.

TITICA'CA. The largest freshwater lake of South America. It has an extreme length of 130 miles and a mean breadth of 44 miles; area, 3200 sq. miles, or a little less than half the area of Wales. One half is in Peru, the other in Bolivia. It has an altitude of 12,800 feet, and drains by the Desaguadero into the salt lake of Poopo or Aullagas, in Bolivia. At one time it was of much greater area and drained to the Amazon basin. *See* BOLIVIA; PERU (*Transport* section).

TITLE-DEEDS, in law, are the documentary evidences of ownership of real property. It is a felony for any person to destroy, obliterate, cancel, or alter any document of title to land with any fraudulent intent.

TITMOUSE, TIT, or **TOMTIT.** The name given to a number of perching birds inhabiting most parts of the world, and constituting the family Paridæ. They are very active little birds, continually flitting from branch to branch, devouring seeds and in-



Titmouse (Great Tit)

sects, and not sparing even small birds when they happen to find them sick and are able to put an end to them. Their notes are shrill and wild. They build in the hollows of trees, in walls, etc. The great titmouse (*Parus major*) is between 5 and 6 inches long, and inhabits Britain and Europe generally.

Other British species are the blue titmouse (*P. cærulĕus*), the coal-tit (*P. ater*), the marsh-tit (*P. palustris*), and the long-tailed tit (*Acredula caudata*). The crested titmouse (*P. cristātus*) is comparatively rare in England, but common on the Continent, as is the so-called bearded titmouse (*Panurus biarmicus*), more properly termed the bearded reedling, and belonging to another family (Panuridæ). Several species are North American, some of them known as *chickadee* (q.v.).

TITRATION. A method adopted in chemical analysis. It consists in running a solution of known strength from a burette into a given volume

of a solution of the substance to be analysed. The completion of the reaction between the two solutions is determined usually by a change of colour, often of a third substance, e.g. litmus, which is termed an indicator. The quantity taken from the burette being known, the chemical information desired can be obtained.

TITUS, or, in full, **Titus Flavius Sabinus Vespasianus.** Roman emperor, born A.D. 40, died 81. The eldest son of the Emperor Vespasian, he served with credit as a military tribune in Germany and Britain, and accompanied his father in the war against the Jews as commander of a legion.

When Vespasian became emperor (69) Titus was left to conduct the war in Judæa. He took Jerusalem (A.D. 70), and after visiting Egypt returned to Rome in triumph, and was associated with his father in the government of the empire. He became sole emperor in 79, and showed himself as an enlightened and munificent ruler, distinguished by benevolence and philanthropy. His brother Domitian was strongly suspected of having poisoned him.

TITUS, in the New Testament, is the name of a young pagan convert to Christianity, of whose birth, home, and conversation nothing is known. He suddenly appears in the controversy over circumcision between the two parties in the primitive Church. Paul took him to Jerusalem as an object-lesson, to clinch the argument that Gentile Christians did not require to be circumcised in order to enter the Church of Christ.

After this stormy scene, Titus appears in Paul's company as one of the evangelists and missionaries. He proved an energetic and reliable deputy, especially in connection with the Achaian Christians, and was employed in raising funds at Corinth for the Jewish Christian poor, a task which he accomplished with success.

The only other incident in his life is a subsequent mission to the Island of Crete, where, as the Epistle to Titus implies, he was in charge of the local churches. Paul had left him to superintend affairs in that island, where the Church was in some disorder. When his mission to Dalmatia (2 Tim. iv., 10) occurred, we do not know. He was evidently a man of organising ability, one of Paul's younger colleagues, perhaps one of his converts (Titus, i., 4), who served the interests of the mission loyally.

Titus is never mentioned in the Acts of the Apostles; all that is known of him has to be inferred from the allusions in Paul's epistles (2 Cor. ii., 13; vii., 6, 13-14; viii., 6, 16, 23; xii., 18; Gal. ii., 1-3, and the Epistle to Titus). In later traditions he was regarded as living a celibate life in Crete, dying as an aged bishop. For centuries his name was one of the glories claimed by Crete, especially in its conflicts with Venice.

TITUS, EPISTLE TO. One of the three pastoral epistles of the New Testament (the remaining two being those addressed to Timothy), believed to have been written by St. Paul after his first imprisonment at Rome. The topics handled are the same which we find in the other two kindred epistles. *See* TIMOTHY, EPISTLES TO.

TIV'ERTON. A municipal borough of Devonshire, England, at the confluence of the Loman and Exe Rivers. Lace and flour are made, with some beer. Pop. (1931), 9611.

TIV'OLI (ancient **Tibur**). A city of Rome, Central Italy, on the Teverone (or Anio), which here forms fine falls, having a drop of over 300 feet, and supplying power for the electric lighting of the city. Among ancient remains are the circular temple of Sibyl and the ruins of Hadrian's villa. Pop. 16,000.

TLAXCA'LA. A state of Mexico, an enclave of Puebla and Mexico states. It is very mountainous; area, 1534 sq. miles; pop. (1930), 204,424.

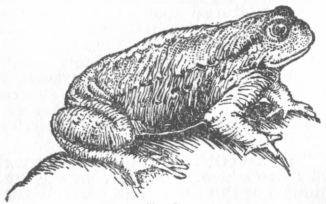
TLAXCALA. A town of Mexico, capital of the state of Tlaxcala; served by rail from Mexico City. It was an Indian capital of Mexico. Trade is in agricultural produce. Altitude, 8000 feet; pop. 3000.

TLEMCEN. A town of Algeria, in the province of Oran, on the Moroccan Railway. It stands in the midst of olive groves, vineyards, and orchards, and was once a Moorish capital city. Pop. (1931), 46,060.

TOAD. The name applied to various genera of tailless amphibians. Toads have a thick bulky body, covered with warts or papillæ. They have no teeth, and the tongue is fixed to the front of the mouth, but the posterior extremity is free and protrusible. The hind feet are but slightly webbed. They leap badly, and generally avoid the water, except in the breeding season. Their food consists of insects and worms. Toads have a most unprepossessing aspect and outward appearance.

The common toad of Europe (*Bufo vulgāris*) was formerly considered dangerously poisonous, and, though it is innocuous to human beings, its skin secretes a poison which serves as

a defence. Besides the common toad, the natterjack (*B. calamita*) is the only British species (*see* NATTERJACK). The toad is easily tamed, and exhibits a considerable amount of intelligence as a pet. It lies torpid in some hole during winter. Insects are caught by a sudden protrusion of the tongue, which is provided with a viscous secretion.



Toad

There are some ten species of toads in North America. The Surinam toad is described in the article PIPA. The toad is extremely tenacious of life, but experiments have conclusively shown that there is no truth in the oft-repeated stories of the creature being able to support life when enclosed in solid rock for immense periods of time. Dr. Buckland has shown that when excluded from air and food, frogs and toads, in virtue of their slow circulation and cold-blooded habits, might survive about a year or eighteen months at most.

TOAD-FLAX. The English name of various plants of the genus Linaria, order Scrophulariaceæ. The common toad-flax is *L. vulgāris*, which in its general habits is not unlike flax. The flowers are of a bright yellow; the corolla labiate, resembling that of snapdragon in shape, but provided with a long spur. It grows in hedges and fields, and is a reputed purgative and diuretic. The ivy-leaved toad-flax (*L. Cymbalaria*) is often found trailing over old walls. Allied to this genus is the Antirrhinum (q.v.).

TOBACCO. The name of several species of Nicotiana (nat. ord. Solanaceæ), the leaves of which are variously prepared. They are manufactured in various forms, such as cigars, cigarettes, chewing and smoking tobacco, and snuff, collectively also known as tobacco, and have, when used in moderation, a sedative effect on the nervous system. The consumer, however, readily becomes addicted to tobacco, which, when indulged in to excess, may be injurious to the nerves and constitution, owing to the nicotine contained in the leaf.

Botany: Cultivation and Preparation. The tobacco plant is an annual. It has a single stem from which the leaves sprout, and which terminates in a pinnacle of flowers. It is grown from seed. The seeds are exceedingly small, about 400,000 going to the ounce. Mixed with sand or fine ashes, the seeds are planted in spring in specially prepared nursery-beds of rich soil, exposed to sunlight, the beds being open or covered with glass or canvas, according to the climate. After six to eight weeks, the plants are transplanted to the open and set in straight rows, 1 to 3 feet apart, according to the type of tobacco and to local custom.

The mature plant, of *N. tabacum*, the Virginia type of tobacco, a native of Central or South America, attains a height of over 6 feet and bears pink flowers. The plant has alternate simple oblong lanceolate leaves, attaining 2 feet in length. Another species, *N. rustica*, has greenish-yellow flowers, with a shorter tube, while the plants as well as the leaves

Toad-flax (*Linaria vulgāris*)

are smaller. Besides these there are about fifty other species.

In order to obtain leaves of the desired quality or size, the flowers are cut out of the plants (topping), and only a few plants are allowed to develop seeds. The plants mature in about sixty days after leaving the nursery-beds. The lower leaves turn

yellow and ripen first. In some countries these are collected before the rest of the plant ripens. They are of a different character (lighter and less gummy) than the other leaves of the same plant, and hence serve different purposes.

While in some countries all the leaves are picked off the stem in the field, in the case of most American tobaccos the whole plant is cut, and the leaves are taken off after the plants have wilted. Thus the leaf becomes gummier because of the juices which pass into it from the wilting stem. In various countries the wilted leaves are tied into bundles (hands) by means of inferior tobacco leaves or dried grasses, or they are strung on strings. In any case, they are hung up in barns and dried.

When dry, the tobacco is massed in piles and allowed to lie. It then ferments, and the fermentation produces heat. The temperature of the piles is carefully observed by means of thermometers, since over-heating leads to damage by over fermentation. The fermentation may be stopped by taking down the piles and spreading the leaves. The piles are occasionally rearranged so as to put the outside leaves inside, where the strongest fermentation takes place. The object of fermentation is to affect the colour and the flavour (ripening, curing), and to make the tobacco keep.

Tobacco, once properly fermented, can be packed in bales, cases, or hogsheads [1] for transportation and storage, and can be preserved for many years without deteriorating. In fact, since most tobaccos undergo renewed fermentation in summer heat, their quality improves through ageing; but bright colours are apt to grow darker. Some varieties, therefore, such as bright Virginia, North Carolina, and Burley tobaccos, are exposed to steam heat (steam dried) before packing, in order to ensure the proper preservation of the tobaccos and particularly of their bright (yellow or light-brown) colour.

Since fermentation has the added effect of rendering the leaves supple, the packing into bales, cases, or hogsheads is sometimes done immediately after fermentation. In other instances the leaves are exposed to steam, or merely to the dampness of the atmosphere, before being packed. The packing is done under pressure, sometimes even hydraulic, so that the leaves in the packages are often considerably twisted and intertwined.

Manufacture. Practically every process of the manufacture of tobacco is begun by applying water or steam to the tobacco leaves as taken from the packages, which renders them as supple as chamois skin, since leaf tobacco readily absorbs moisture from the atmosphere; in some cases it is merely exposed to damp air in order to render it pliant. In this state the leaves which were mixed and wrinkled in the packages can be unfolded and manipulated without breaking.

Smoking-tobacco. After different varieties of leaves have been mixed and sometimes sprinkled with flavour-

Tobacco Plant, Leaves and Flowers

ings, as, for example, liquorice or fruit extracts, they are cut by machine into narrow strips or small flakes. In some cases the midribs of the leaves are previously removed (stripped or stemmed). Some cut tobaccos are roasted in drums. Another way of making smoking-tobacco is by breaking dried leaves into small particles (granulating). The simplest way to make smoking-tobacco, which is adopted by many tobacco-growers, is merely to rub dried leaves to pieces in the hand. The packing of smoking-tobacco into tins or retail packages is done by machine.

Rolled or Spun Tobacco. In some countries fat juicy leaves are thoroughly soaked or boiled in sweet flavourings, and are, by mechanical means, twisted or spun into ropes, pieces of which are twisted into small coils and dried. In other countries heavily flavoured and sweetened leaves

[1] The weight of bales varies, according to local usage, from about 20 lb. to over 300 lb.; cases weigh approximately 350 lb. net, while hogsheads vary from approximately 500 to 2000 lb. net.

of a spongy texture are rolled up and hydraulically pressed and dried (plug). In other countries, again, tobacco leaves of tough texture are sliced into strips as for smoking-tobacco, and thus sold for chewing purposes. This tobacco, after being chewed, is often dried by the consumer and smoked in his pipe.

Snuff. Thick, fleshy dark leaves are most suitable, and after being treated with liquorice, tonka beans, or other flavouring matter are moistened and heaped up for several weeks, in order to ferment strongly. The leaves are dried, ground, and repeatedly fermented anew. The product (snuff) is a very fine black, brown, or light-grey powder. Snuff is mostly applied to the nostrils, but sometimes to the gums.

Cigars. A cigar is composed of three parts, the filler, the binder, and the wrapper. The filler is usually an admixture of small pieces of leaves of various kinds of tobacco, the midribs of which have been removed, after slightly moistening the leaves. The breaking up of the leaves is mostly done by hand, sometimes by machine. A handful of filler is pressed by the fingers into a cylindrical mass and rolled with the palm of the hand (sometimes with the flat side of a special half-moon shaped implement) on a board of about 1 foot square lying on the working table into a piece of moist and pliable stripped leaf, called the binder.

This half-product (bunch) is now enveloped by a narrow strip cut out of a stemmed leaf of a particular colour and texture (the wrapper), into which it is rolled on the bias, also by hand. The wrapper covers the cigar in spiral fashion, and is kept from unrolling by being pasted at the pointed end of the cigar. At the other end unevennesses are trimmed off. In some countries these trimmings and waste that falls off the leaves from which the wrappers and binders are cut are packed in bales or cases, and are an article of—even international—trade (cuttings).

It is a general but erroneous idea that cigars of light colour are milder than dark cigars. The mere fact that the wrapper constitutes only a very small percentage of the tobacco contained in a cigar goes to prove that its effect is insignificant compared with the effect of the qualities of the filler, the colour of which is hidden from sight. There are machines for making bunches and also for cutting and rolling wrappers, but the delicate touch of the hand of the experienced cigar-maker cannot thus be replaced.

A wooden mould in which the bunch is pressed and dried, so as to give it the desired shape, is largely used, but the difference from the entirely hand-made product is noticeable to the connoisseur. While some imported Havana, Brazil, or Manila cigars are made from one variety of tobacco throughout, cigars manufactured in Britain are mostly made of several varieties properly blended. Sometimes the tobacco for cigars is artificially flavoured.

Cheroots, cigarillos, and **stogies** are thin cigars of cylindrical form, often made without binders. They frequently have a coarse appearance, as a particular attraction to the smoker.

Cigarettes consist of thin rolls of shredded tobacco wrapped in thin white paper. While in the Latin countries cigarettes are made of what is termed cigar-tobaccos, elsewhere particular varieties of yellow and light-coloured (preferably Turkish) tobaccos are used, the leaves of which often measure not more than 2 inches in length when mature. Cigarette tobaccos are sometimes flavoured (sweetened), while the addition of opium also occurs.

Originally the smoker rolled his cigarette himself between his fingertips, or stuffed the tobacco into small tissue-paper tubes bought for the purpose. Cigarettes are now largely made by automatic machines, which roll the shredded tobacco into a long rope. This, while gliding forward, meets a narrow tape of thin paper which is being unrolled from a coil and which travels at the same speed in the same direction, and which, while enveloping the rope of tobacco, is fastened around it (glued or crimped).

The machine cuts this endless cigarette into small bits of the required size; it prints the name of the brand and its maker on the paper; it gilds the tips or puts cork on them as required, and is perhaps one of the most ingenious machines in existence, covering, as it does, an entire process of manufacture, including the packing for retail. Some of these cigarette-machines turn out tens of thousands of cigarettes per hour.

By-products and Half-products. Among these are the midribs, stripped from the leaves (English stalks, American stems). They are soaked, rolled flat, and used as a substitute for common grades of leaves, in practically all varieties of tobacco products.

Many manufacturers do not utilise the stalks of their tobacco, but sell them for international trade. Tobaccos destined for British manufacture are often stripped abroad for economic reasons in connection with

duties. The stemless leaves (strips) are packed tangled or tied flat in bundles (books), as the case may be, and shipped to England. Extracts and juices are made of the heavier and most juicy varieties of leaf and stalk, and used for flavouring the products of other tobaccos, for washing sheep, as insecticides, and for chemical purposes. The pulp is used as manure.

Chemistry. Products of the analysis of tobacco are water, ash, nicotine, nitric anhydride (N_2O_5), ammonia (NH_3), fibre, starch, nitrogen free extract, and ether extract. Their relative quantities vary not only in different varieties of tobacco, but also in the fermented and unfermented states of the same variety. Hence it lies beyond the scope of this article to attempt a tabulation. It may suffice to state that *nicotine* ($C_{10}H_{14}N_2$), a volatile alkaloid, appears to be present only in plants of the genus Nicotiana.

Markets, Prices, Taxation, Trade. In localities where tobacco is grown there are markets to which the planters, in so far as they do not pack their product themselves, bring it, and where it is sold (frequently by auction) to merchants who specialise in fermenting, assorting, and packing tobacco into the packages in which it is handled in trade, and in selling it from these local markets.

Among these markets are Lexington and Louisville, Kentucky; Clarksville, Tennessee; Danville, Virginia; Hartford, Connecticut; Lancaster, Pennsylvania; Canton and Shanghai, China; Madras and Calcutta, British India; Smyrna, Samsun, and Trebizond, Turkey; Kavala and Nauplia, Greece; Sofia, Bulgaria; Algiers and Bôna, Algeria.

Colonial tobacco is packed on the plantations and shipped to the mother country, where it enters the world trade—London for British North Borneo, Africa, and other tobaccos (private sales); Amsterdam and Rotterdam for Java and Sumatra tobacco (sales by tender). The chief world markets for the general leaf-tobacco trade are, in Alphabetic order: Amsterdam, Antwerp, Bremen, Dresden (cigarette tobaccos only), Hamburg, Liverpool, London, New York, Rotterdam.

In these cities manufacturers from various countries find among the stock of tobacco merchants leaf tobacco from practically every part of the world, so that by comparison of the qualities and merits of the various varieties of tobacco leaf a world market value originates for each. The high duties on leaf tobacco, and the restrictions which these necessarily impose on the leaf-tobacco trade, without doubt prevent Great Britain and the United States from developing the leading tobacco markets of the world.

Tobacco is now grown in almost every country. The following table shows the world production for 1931:

Source	Tons
U.S.A.	730,000
British India ..	630,000
U.S.S.R.	135,000
Neth. E. Indies ..	85,000
Japan	70,000
Greece	42,000
The World (estim.)	2,300,000

A vast amount of tobacco is grown in China, but no statistics or even approximate figures are available. A certain amount is exported.

More than three-quarters of the tobacco used in Britain comes from the U.S.A., but Empire-grown tobacco (mainly from Nyasaland, which exported 10,690,581 lb. in 1931, and Rhodesia) is increasing in favour, there being a preferential duty. In 1927-8 the tobacco duty on a total import of *c.* 130,000,000 lb. was £58,206,703 (for comparative figures see below).

British Customs Receipts

1929..£59,194,861
1930.. 62,909,202
1931.. 64,187,910 } 1913, £17,254,125
1932.. 63,400,948

Duty. On unmanufactured tobacco containing 10 per cent or more of moisture in every 100 lb. weight thereof the duty is: stripped and stemmed, 9*s.* 6½*d.* per lb.; unstripped, 9*s.* 6*d.* per lb.; a preference equal to five-sixths of the maximum rate being accorded to Imperial produce. Where less than 10 per cent moisture is contained, 10*s.* 6*d.* per lb. stripped, and 10*s.* 6½*d.* unstripped is levied. On manufactured tobaccos and snuffs the duty is much higher, reaching 18*s.* 1*d.* per lb. on cigars.

The trade in and appraising of leaf tobacco requires expert judgment, since no quotations of classifications can give guidance to the outsider as to the peculiar qualities of various grades. Although it is impossible to give an adequate idea of the various points by which tobaccos are appraised, one may say, in general, that the size and shape of the leaf, its texture, colour, specific weight, com-

bustility and the colour of its ashes (white preferred), its aroma, its taste and the taste and smell of its smoke are all factors in its appreciation.

While the appreciation varies according to the taste of the individual and to local and national preferences in general, the colours preferred for cigarette and smoking tobacco range from canary-yellow, light-brown, dark-brown, to almost black, while cigar tobaccos are generally brown, though mouse-grey is at present a fashionable colour for cigar wrappers.

The valuation of the leaf by individual manufacturers is greatly influenced by the taste of their customers, which varies greatly according to locality (climate) and nationality, by the duties imposed on leaf tobacco in their countries, and by the dexterity of their working staff.

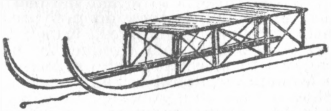
In most countries excises are imposed on domestic manufactures and duties raised on imported manufactures and on leaf tobacco. In some countries, such as France, Italy, Morocco, Spain, Sweden, Austria, and Czechoslovakia, the Government monopolises the manufacture and sale of tobacco products, but sometimes leases its rights. Since different grades and varieties of tobacco are required for different products, and since different countries grow widely varying styles of tobacco (even slight variations in climate or soil bringing about great differences in plants of the same variety, practically no two countries producing identical tobaccos), almost none grow all the varieties they require. Hence most producing countries, though they export large quantities of home-grown tobacco (e.g. the United States), nevertheless import foreign leaf tobacco.

TOBA'GO. An island of the British West Indies, a political dependency of Trinidad, 24 miles south-west; area, 114 sq. miles. It is of volcanic formation, comprising a dorsal ridge, 18 miles long and 1800 feet altitude, surmounted by conical hills. Cocoa, coco-nuts, and copra, with some vegetables, poultry, eggs, fruit, and livestock are the chief exports. There are seven parishes: St. Patrick, St. Andrew, St. David, St. George, St. John, St. Paul, and St. Mary. Scarborough (pop. 729) is the chief town. Tobago was discovered by Columbus in 1498, and was definitely ceded to Great Britain by France in 1814. Pop. 26,000.

TOBERMORY. A burgh and seaport of Argyllshire, Scotland, in the Island of Mull. One of the ships of the Spanish Armada was blown up in the bay in 1588. After several unsuccessful attempts to recover treasure, Colonel Foss commenced operations in 1912, and found valuable relics. Further salvage operations were conducted in late years. Pop. (1931), 771.

TOBIT, BOOK OF. One of the Old Testament apocryphal books, rejected by the Jews and Protestants, but included in the Roman Catholic canon. It contains an account of some remarkable events in the life of Tobit, a Jew of the tribe of Naphtali, carried captive to Nineveh, and his son Tobias. The book bears a strong likeness to the tales of *The Thousand and One Nights*, with the obvious exception that the writer has a considerable acquaintance and sympathy with the Old Testament writings.

TOBOGGANING. A winter sport popular in Canada, the United States, and Switzerland. The toboggan (Micmac Indian, *tobaakan*) is a light sled mounted on steel or steel-shod



Toboggan

runners; it carries a single passenger, who lies on it face downwards, steering with his toes. In Switzerland, where Symonds did much to popularise the sport, the most famous "run" is that of the Cresta, St. Moritz, 1400 yards in length, with a drop of 500 feet, and a wide variety of curves and gradients.

Here the Grand National competition, open to the world, takes place. Another well-known course is that upon the Klosters-Davos road, 2 miles long, 800 feet fall, on which the International and Symonds Shield competitions are held. The negotiation of corners at high speed demands much skill, for a pace of 75 miles an hour is at times attained. The bobsleigh is a toboggan for two or more passengers.—Cf. *Ice Sports* (Isthmian Library).

TOBOL. A river of Siberia, which rises in the Ural Mountains and joins the Irtysh after a course of about 550 miles.

TOBOLSK'. A former government of Western Siberia, drained by the Ob' and Irtish Rivers, and producing gold, coal, saltpetre, live-stock, wheat, and rye. Tobolsk is the capital. Area, 535,739 sq. miles; pop. 2,000,000.

TOBOLSK. Capital of the government of Tobolsk, Western Siberia, on the Tobol where it joins the Irtish. Fighting took place at Tobolsk in 1919 between Koltchak's forces and the Bolsheviki. After the Revolution of 1917, the ex-Tsar Nicholas II. was imprisoned in the town. Pop. 18,268.

TOCANTINS'. A river of Brazil, which rises in lat. 10° S., flows northward, receives the Araguay, and enters the Atlantic by the Pará estuary, forming one mouth of the Amazon. The entire course is 1500 miles, but navigation is impeded in parts.

TOC H. Organisation for Christian fellowship and social service. It originated during the European War at Poperinghe, where Talbot House (so named after a fallen officer, and founded by the Rev. P. T. B. Clayton), served as a club and a church for soldiers from Dec., 1915. Toc H is the army signaller's name for the initials T. H. The aim of the movement is to uphold the ideals of fellowship and service. In 1922 it was incorporated by royal charter. It has now (1933) 1000 branches scattered all over the world, with headquarters at 1 Queen Anne's Gate, London, S.W. 1, and its guild church is All Hallows, Barking-by-the-Tower.

TOCQUEVILLE (tok-vēl), **Alexis Charles Henri Clérel de.** French politician and writer, born in 1805, died in 1859. His chief work was *La Démocratie en Amérique* (1834), which was translated into the principal European languages. In 1849 he accepted the portfolio of foreign affairs, but soon resigned it. After the *coup d'état* of 1851 he lived in retirement. His other works include *L'Ancien Régime et la Révolution* and *Histoire philosophique du règne de Louis XV.*

TODAS. A race inhabiting the upper part of the Nilghiri Hills of Southern India, considered to be of Dravidian stock. They form a typical polyandrous community (about 750 in number), in which a woman is the wife of her husband's brothers.

TODEA. A small genus of Ferns, family Osmundaceæ, natives of the southern hemisphere. Some species are "filmy ferns."

TOD'HUNTER, Isaac. British mathematician, born at Rye in 1820, died in 1884. He studied at University College, London, and afterwards graduated as senior wrangler from St John's College, Cambridge, where he resided as Fellow, tutor, and principal mathematical lecturer until his death. He wrote a series of popular mathematical textbooks, and valuable histories of certain special branches of mathematics and mathematical physics, including probability, the calculus of variations, attraction, and elasticity.

TODLEBEN (tod'lā-bèn), **Franz Eduard Ivanovitsh, Count.** Russian soldier and military engineer, born 1818, died 1884. Entering the Russian army (1836), he served against the Circassians (1848), took the chief part in the defence of Sebastopol (1854), and, after the peace of 1856, wrote his monumental *Défense de Sévastopol.* During the Russo-Turkish War, Todleben was sent (1877) to reduce Plevna, was created count, and subsequently became Commander-in-Chief of the Russian army in Turkey. He was appointed Governor of Odessa (1879) and (1880) of Vilna.

TODMOR'DEN. A municipal borough and market town of England, in Yorkshire (West Riding), on the Calder. It has extensive manufactures of cotton goods. Pop. (1931), 22,223.

TODY. The name of certain tropical birds, genus Todus, sub-family Todinæ, family Momotidæ, inhabiting the larger islands of the West Indies. They are birds of gaudy plumage, and feed on insects, worms, etc. The best-known species is the green tody (*T. viridis*), a pretty bird, about the size of a wren. It is very common in Jamaica.

TOGA' (Lat. *tegere*, to cover). The principal outer garment of wool worn by Roman citizens. It covered the whole of the body except the right arm, and it was originally worn by both sexes until the matrons adopted the *stola.* The *toga virilis*, or manly gown, was assumed by Roman youths when they attained the age of puberty. The variety in the colour, the fineness of the wool, and the ornaments attached to it indicated the rank of the citizen; generally it was white. Under the emperors the toga went out of fashion, giving place to lighter and more convenient garments of foreign origin. See illus. p. 248.

TOGO, Heihachiro, Count. Japanese Admiral, born 1847, a Satsuma Samurai; educated, H.M.S. *Worcester* and at the Naval College, Greenwich (1873-4). During the Chino-Japanese War he had a command, and was Commander-in-Chief of the Japanese fleet during the Russo-Japanese War (1904-5), his most brilliant action being Tsushima. Togo became a member of the Order of Merit in 1906, and is one of the three honorary members, Foch and Joffre being the other two.

TOGOLAND. A former German West-African colony divided between Great Britain and France after the European War.

Physical. Togoland is divided into a transmontane and a cismontane region by a hill-range (Mount Agu, 3370 feet) built up of quartzites and mica-schists, and trending north-east to south-west. It has various names in different districts.

The transmontane district is the larger, and comprises mainly the valley of the Oti through which it is

Method of wearing the Toga, from an ancient Roman statue

drained to the Volta (q.v.), being separated by the Gambaga Hills from a narrow frontier tract which belongs physically to the Gourma Plateau. South-east of the hills the region becomes narrower, and the seaboard on the Slave Coast (Bight of Benin) is only 32 miles long. There is a coastal plain fringed by a broad bank of yellow sand, formed by the scouring of a powerful coastal current (the Kalema) which manifests itself in the heavy breakers beating upon the shore, and which has dammed up and is gradually filling a series of lagoons.

Of these lagoons the largest is the Togo or Avon (Ger. *Togo See*), into which fall the Rivers Haho and Schio, and upon which stands Togo town. The alluvium deposited by the rivers is also gradually filling up the lagoons. Togo Lagoon is drained to the mouth of the Monu River by the Wo and Anecho (or Popo) Lagoons and a channel running behind the sand-bank. Behind the coastal plain a savanna extends for 50 miles, and is separated by a depression from the plateau of the interior, which rises inland to an altitude of over 1400 feet.

Climate and Health. Togoland has a humid tropical climate, and it is not a white man's country. A large southern and south-central zone is dominated by the tsetse fly, and malaria is prevalent. In the dry months and in the north of the country cerebro-spinal meningitis is common, as are dysentery, smallpox, leprosy, skin diseases, and sleeping-sickness in the south. Goitre and tuberculosis are fairly common, and there are many endemic diseases unknown to European medicine.

There are two rainy seasons in the south, viz. March-June and September-November, and in the north only one, April-October. February and March are the hottest months, the coastal temperature then averaging 80° F., and the highlands (at Bismarckburg, one of the healthiest places) 79° F. July and August are the coldest months, with a mean temperature of 74° F. on the coast and 70° F. at Bismarckburg. From December to February the Harmattan (q.v.) blows. Frequent droughts are caused by the drying up of rivers, none of which may be considered perennial, unless in the highlands, where they always contain water, and where there are from 150 to 200 thunderstorms per annum.

Area, Towns, etc. The total area of Togoland is 33,700 sq. miles (i.e. about the size of Portugal or Ireland), but it is partitioned between Britain and France, the former administering 13,041 sq. miles with a population (1931) of 275,925. For administrative purposes the British portion is attached to the Gold Coast Colony and is in every way a part of it. The area of the French portion is 21,893 sq. miles. In 1932 the population of all Togoland was 749,419 natives and 646 Europeans. German figures show that in 1914 there were 368 Europeans, 320 being German. Besides Lome, towns located on the sand-spit are Anecho or Little Popo; Porto Seguro (pop. 1200), the port of Togo town; and Bagida. Sansane-Mangu (9000), Sokode (4000), Bassari (10,000), Yendi (10,000, a fairly healthy place), Bismarckburg (founded 1894 as a European station), Kete Krachi (8-9000), Atakpame (10,000), Misahöhe (founded

in 1890 as a Government station), Kpandu (3000) are other places.

Communications. Lome (pop. 5800) is the chief port of the region and its natural outlet. Railways are of metre gauge, and have Lome as a nodal point, whence they run: (1) along the coast to Anecho, a distance of 27 miles; (2) to Palime (74 miles, pop. 1000; for Misahöhe); and (3) to Atakpame (103 miles).

Production. The chief agricultural products are maize, sweet potatoes, dukhn (in the north), cotton (widely in the south), cane-sugar, durra (a native staple), rubber (wild and cultivated), some tobacco, ground nuts (the main product of the north), tea, coffee, piassava fibre, tapioca, sesame, rice, kola-nuts, pepper, yams, and many fruits, including pineapples. Among trees the chief are the coco-nut palm, the oil-palm, and the shea tree. Palm-oil and kernels from the second of these, and copra from the first named, are important articles of export, but are run closely by shea butter, a valuable commercial product used in the manufacture of candles, soap, and margarine.

Horses do not thrive in Togoland, and mules do better. Goats and sheep are kept in large numbers. Among minerals, gold, bauxite (an ore of aluminium), chromite, and galena have been found; and numerous deposits of iron ore (hæmatite) exist at Banyeli, remote, however, from any organised system of transport, and therefore unworkable on a large scale.

History. The Portuguese traded with the coast of Togoland during the fifteenth century, and to them the introduction of the coco-nut palm is usually ascribed. In 1680 the Elector of Brandenburg sent an expedition to Togo, where he secured a trading monopoly; but on his death all rights were surrendered to the Dutch for a cash payment (1718). On 5th July, 1884, Togoland was declared a protectorate of Germany, and the hinterland was rapidly and efficiently occupied and explored. Togoland was not only the first German imperial colony in Africa, but was also unique as self-supporting.

In 1914 von Döring was Governor, and he did not expect that Great Britain would participate in the impending war, preparing himself for the invasion of Dahomey on this assumption. Anglo-French troops under the command of Captain F. C. Bryant invaded Togo, and after a brilliant little campaign trapped von Döring in Kamina, where he (with 205 Europeans) surrendered unconditionally on 26th Aug., 1914. In 1919 the Supreme Council awarded the mandate for the administration of the territory to France and Great Britain. This was confirmed by the League of Nations.

BIBLIOGRAPHY: *Meyers Grosses Konversations-Lexikon*, article *Togo*; *Peace Handbook No. 110* (a British Government publication, H.M. Stationery Office); A. F. Calvert, *The German African Empire*; Miss M. Gherts, *A Camera Actress in the Wilds of Togoland*; *Report on the Trade and Agriculture of Togoland* (Cd. 7048-52, H.M. Stationery Office); Evans Lewin, *The Germans in Africa*; Royal Geographical Society, *First List of Names in Gold Coast and British Togo*.

TOKAR. A town of Sudan, in the Red Sea Province. The district is a cotton-growing region. Pop. 20,000. —Another Tokar is a Hadendoa settlement in Kassala.

TOKAT. A town of Turkey in Asia. It has Roman remains, etc. Pop. 22,390.

TOKAY. A town of Hungary, at the conflux of the Rivers Tisa and Bodrog. The wine grown in its vicinity (Tokay) is noted. Pop. 5300.

TOKENS. Pieces of money current by sufferance, and not coined by authority; or coins only nominally of their professed value. In England tokens first came into use in the reign of Henry VIII., owing to the want of authorised coins of lower value than a penny. Stamped tokens of lead, tin, and even leather were issued by vintners, grocers, and other tradesmen during the time of Elizabeth, and were extensively circulated, being readily exchanged for authorised money at the shops where they were issued. A currency of this kind (mostly of copper) was much used in Britain towards the close of the eighteenth century.

TOKYO (formerly **YEDO**). The capital of the Japanese Empire and the seat of the Tennō (Emperor), on the Bay of Tokyo, Island of Honshu. It is divided by the River Sumida, and is the terminus of several railways. There is a *ceinture* as in Paris. The greater part of the town is flat, and intersected by numerous canals crossed by bridges. Tokyo may be considered the centre of the political and literary activity of Japan, and commercial interests are slowly developing. The university is of world importance. There is an imperial palace, and a zoological garden is located in the Uyeno Park, where there is also an imperial museum. Pop. (1930), 4,978,390. During the terrible earthquake of 1st Sept., 1923, Tokyo was almost destroyed.

TOLAND, John. English deist, born in 1670, died in 1722. He entered Glasgow University in 1687, graduated M.A. at Edinburgh in 1690, and afterwards studied theology at Leiden. In 1696 he published his *Christianity not Mysterious*, which created a great sensation, and was burnt by the hangman at Dublin by order of the Irish Parliament in 1697.

He subsequently settled down as a voluminous pamphleteer in London. Of his other works the chief were: *Life of Milton* (1698), accompanying an edition of his writings; *Anglia Libera* (1701); *Socinianism Truly Stated* (1705); and *Pantheisticon* (1750). In the last of these works Toland distinctly avowed himself a pantheist.

TOLE'DO. A province of Central Spain. It is mainly a high plateau cleft in the north-west by the high valley of the Tagus, to the basin of which it chiefly belongs. Agriculture is the chief occupation. Toledo is the capital. Area, 5919 sq. miles; pop. (1931), 494,042.

TOLEDO (ancient **TOLETUM**) A city of Spain, capital of the province of Toledo, on the Tagus, and 1820 feet above sea-level; on the railway from Madrid. It is the see of an archbishop, who is Primate of Spain. It is one of the most interesting cities in Spain, and "an epitome of its history." Its chief glory is a Gothic cathedral, one of the grandest in the world, completed in 1492. The Toledo sword-blades, renowned for centuries, are manufactured (with cutlery in general) in a Government establishment. Toledo was taken by the Romans in 193 B.C., and was subsequently the seat of government under the Goths, Moors, and Kings of Castile in succession. Pop. 27,443.

TOLEDO. A city of Ohio, United States, the county seat of Lucas county, on Lake Erie; served by the Pennsylvania and other railways. Toledo is the terminus of the Miami and Erie, and the Wabash and Erie Canals, and exports flour, grain, cattle, beef, pork, hides, wool, tobacco, and timber. There are large wagon-works, machine-shops, foundries, flour-mills, and manufactories of tobacco, flax, cotton, and chandlery. Founded in 1833, it was incorporated as a city in 1836. Pop. (1930), 290,718.

TOLENTI'NO (ancient **TOLENTINUM PICENUM**). A city of Marches, Central Italy, in the province of Macerata. Here Pope Pius VI., in 1797, concluded a humiliating peace with Bonaparte, and in the neighbourhood, in 1815, Murat, at the head of the Neapolitans, was defeated by the Austrians under Bianchi. Pop. (commune), 14,300.

TOLERANCE. In engineering, the amount of variation allowed from exact accordance with specified dimensions. The very idea of tolerance presupposes the existence of instruments capable of making measurements with precision, especially measurements of length. The simple method of placing a rule against an article and reading the scale has great limitations. The limit of precision possible in that way is about the nearest fiftieth or sixty-fourth of an inch.

That method is too crude to use in measuring machine parts that are to work together with little or no vibration and noise. There are four usual types of fit used: *force*, requiring a screw or press; *drive*, with the use of a hammer; *push*, by hand pressure; and *running*, free enough to run almost indefinitely if lubricated. The *tolerance*, or range between the smallest and greatest allowable dimensions, varies in these four cases, and also proportionately to the size of the part.

In small articles with fine quality of workmanship, limits of a few ten-thousandths of an inch are usual. The instruments of precision used must be of sufficient sturdiness to withstand the respectful but vigorous handling of a turner or machineman. Among such instruments vernier callipers, micrometer gauges, and limit gauges are the most common.

In *vernier callipers* (*see* VERNIER) the main scale is divided into tenths and fortieths, while the vernier has twenty-five divisions. Readings can be made to one-twenty-fifth of a fortieth, that is, one-thousandth of an inch without the use of a lens.

Micrometer gauges have accurately cut screws, whose pitch is usually forty to the inch, and the fractions of a complete turn are measured with a circular scale on the thimble part of the gauge. The circular scale is divided into twenty-five parts, so that the fortieths obtained by complete turns of the screw can be subdivided into thousandths. These gauges are provided with the means of adjustment for wear, and a racket stop whose function is to ensure that the same pressures are applied to the articles measured, no matter how roughly it is turned. Similar micrometer fittings are used in depth, straight, internal, and other gauges.

Limit gauges are made or set to the dimensions which are in use for the maximum and minimum sizes. Limit sizes have been standardised by gauge-makers and by the British

Engineering Standards Committee. As an example, a 3-inch diameter shaft which is to be made a running fit of first quality work must have a diameter between 2·9982 and 3·0000 inches. When much work of this character is done, limit gauges are made to these limiting dimensions, to take the place of micrometer gauges.

The shaft itself must be of a size between the limits, that is, when the gauge test is made the one gap can "go," but the other will "not go" over the diameter. Plug gauges of 3·0018 and 3·0035 inches diameter would be used as the "go" and "not go" gauges to test the dimensions of the hole in which the shaft is to be a running fit. The adjustable gauges have two fixed points on one end, and two adjustable screwed points at the other. These points are set by means of reference bars.

TOLIMA (tō-lē'mȧ). A state of the Republic of Colombia, traversed by the Upper Magdalena, and embraced between the two chief chains of the Cordillera; area, 9,166 sq. miles. It produces cacao, sugar, maize, and tobacco, and is rich in gold, silver, lead, sulphur, and copper. The volcano of Tolima has a height of 18,300 feet. Pop. (1928), 444,593. Capital, Ibagué.

TOLL. A tax paid, or duty imposed, for some liberty or privilege or other reasonable consideration; such as (*a*) the payment claimed by the owners of a port for goods landed or shipped there; (*b*) the sum charged by the owners of a market or fair for goods brought to be sold there; (*c*) a fixed charge made by those entrusted with the maintenance of roads, streets, bridges, etc., for the passage of persons, goods, and cattle.

TOLMIÆA. A genus of plants, order Saxifragaceæ. *T. Menziesii* is a pretty foliage plant often grown in pots. It propagates itself freely from adventitious buds borne at the base of each leaf; hence the popular name "mother-of-millions."

TOLSTOY, Count Leo Nicolævitsh. Russian novelist, religious teacher, and social reformer, born at Yasnaya Polyana, in the government of Tula, 1828, died 1910. He received his earlier education at home, and from 1843 to 1846 studied Oriental languages and law at the University of Kazan. In 1851 he went to the Caucasus, and served in the defence of Sebastopol during the Crimean War. To this period of his career belong his earliest literary works: *Childhood*, *Boyhood*, and *Youth*, and the brilliant descriptions of the Crimean campaign, entitled *Sebastopol*.

On the conclusion of the war he went to St. Petersburg (Petrograd), where he published *The Snowstorm* and *Two Hussars*. In 1857 he travelled abroad, and on his return he retired to his estate to live a simpler life. Greatly interested in the condition of the peasantry, he founded a free village school on his estate, for which he prepared reading and other textbooks himself.

His work *Family Happiness* appeared in 1859, and was soon followed

Count Leo Tolstoy

by *Three Deaths* (1859), *Polikushka* (1860), and others. In 1862 he married the daughter of a Moscow physician, and during the next period of his life he produced the two works upon which his literary reputation chiefly rests, namely, *War and Peace* (1865-8) and *Anna Karenina* (1877), a powerfully realistic study of human passion and its effects.

Anna Karenina, wherein the author depicts the clash between passion and inner duty, marks a transition to the third period of Tolstoy's life, during which he began to develop his views on religion and its application to individual and social life. He began to search for the sense and meaning of life.

He turned to science and philosophy, asking them to solve the riddle of life; but both science and

philosophy failed to answer his questions, and he at last turned to religion. He proclaimed the utter bankruptcy of science, of philosophy, and progress, and came to the conclusion that faith alone could give happiness. Tolstoy then confessed his sins and turned Christian, but he soon freed himself from the Established Church, and worked out his own ideas of Christianity.

In the Gospels he found the fundamental principle for a basis of life. He found it in the Sermon on the Mount, and in the five commandments of Jesus (Matt., v., vi., vii.). Tolstoy's religious, social, and moral ideas may be summed up as follows: In religion we must not resist evil, for the law of the Gospel is the law of peace. Politically the doctrine of Christ admits of neither states, nor armies, nor tribunals. Socially it means the suppression of property and the proclamation of communism.

His social ideal is thus based upon complete renunciation, his moral ideal upon complete purity and chastity. All our social institutions, therefore, which are based upon a state of war and violence must be abolished, not by means of revolutions, but by passive non-resistance. Practically, Tolstoy had arrived at the same conclusions as Prince Kropotkin, but whilst the latter had appealed to revolt, Tolstoy, who believed in the original goodness of man, preached the gospel of non-resistance, of intellectual, passive anarchy.

His whole teaching was therefore a religion of Love and Labour, and he was right when he wrote that "there is no Tolstoism and never will be; all that I have said has already been said eighteen centuries ago, and much better, in the Gospels." Having arrived at these conclusions, Tolstoy endeavoured to put his theories into practice. He wished to distribute all his wealth, but his wife and family opposed his plan, and he was compelled to remain a rich man.

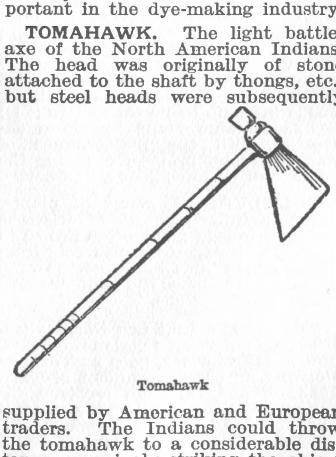
During the last year of his life he made an effort to leave his comfortable home and to disappear among the peasants. He actually left his home, but fell ill and died shortly afterwards. Even those who do not agree with Tolstoy the moralist and social reformer, cannot help admiring Tolstoy the artist and novelist. He is a wonderful painter and an observer of human life. He had a power of psychological analysis, and his works have a Biblical directness and simplicity. The principal works containing Tolstoy's moral, social, and religious teaching are: *My Confession, The Four Gospels Harmonized and Translated, What I Believe, The Power of Darkness, The Kreutzer Sonata, The Kingdom of God is Within You,* and *Resurrection.* — BIBLIOGRAPHY: A. Maude, *L. Tolstoy*; E. Garnett, *Tolstoy: his Life and Writings*; A. S. Rappoport, *Tolstoy: his Life, Works, and Doctrine.*

TOLU-BALSAM. A resin or balsam obtained from a tree of tropical South America, the *Myrospermum* (*Myroxylon*) *toluiferum* or *peruiferum.* Tolu-balsam has a brownish-yellow colour, becomes quite hard and may be formed into a powder, has a pleasant aromatic flavour, and is used in certain medicinal preparations, though it has little or no virtue of its own.

TOLU'CA. A city of Mexico, capital of the state of Mexico, situated 8500 feet above the sea, and served by the National railways. The city has a cathedral, a theatre, etc., and carries on cotton manufacture and other industries. Pop. 36,500.

TOLUENE. Toluol, or methylbenzene, $C_6H_5CH_3$, a hydrocarbon belonging to the same homologous series as benzene, and having the same general properties. It is a colourless liquid boiling at 110° C., obtained by the fractional distillation of coal-tar, from tolu-balsam, and synthetically. It is used in the preparation of explosives, and of benzaldehyde and other substances important in the dye-making industry.

TOMAHAWK. The light battle-axe of the North American Indians. The head was originally of stone attached to the shaft by thongs, etc., but steel heads were subsequently



Tomahawk

supplied by American and European traders. The Indians could throw the tomahawk to a considerable distance, unerringly striking the object aimed at with the edge of the hatchet.

TOMA'TO, or **LOVE-APPLE** (*Lycopersicum esculentum*). A plant belonging to the nat. ord. Solanaceæ. It is a native of South America, but has

been introduced into most other warm or temperate countries. It is cultivated for the sake of its fruit, which is fleshy, usually scarlet or orange, irregularly shaped, and is largely used in sauces, stews, and soups, as well as eaten by itself. The plant is a tender, herbaceous annual, with yellow flowers, and is now much cultivated under glass in many parts of Britain.

TOMBAC, or TOMBAK. An alloy consisting of about 85 parts copper and 15 parts zinc, and used as an imitation of gold for cheap jewellery. When arsenic is added, it forms white tombac.

TOMBIG'BEE. A river which rises in Tishomingo county, Mississippi, United States, and, after a course of 450 miles, joins the Alabama River 45 miles above Mobile to form the Mobile River (q.v.).

TOMELLO'SO. A town of Spain, in Ciudad Real. It is a centre of the wine trade, a great part of the claret and "cognac" of commerce being produced there. Pop. 17,730.

TOMSK. A former government of Western Siberia, belonging chiefly to the basin of the Ob', now part of the Siberian Region Proper of Asiatic U.S.S.R. It is agricultural, but has manufactures of leather and beer, etc., and lead (argentiferous) and copper, etc., are found. Area, 331,160 sq. miles; pop. 3,920,800. Tomsk was the capital.

TOMSK. A town of Western Siberia, U.S.S.R., capital of the former government of Tomsk, on the Tom, and a feeder of the Trans-Siberian Railway. Manufactures include cloth, leather, and soap; and there is an extensive trade in furs, fish, and cattle, obtained in exchange for articles of European and Chinese manufacture. The University of Tomsk was founded in 1888. Pop. 92,418.

TON. A denomination of weight equivalent to 20 hundredweights (contracted cwt.), or 2240 lb. In America goods are sometimes weighed by the short ton, of 2000 lb., the hundredweight being reckoned at 100 lb.; but it is decided by Act of Congress that, unless otherwise specified, a ton weight is to be understood as 2240 lb. avoirdupois.

TONBRIDGE. A town of Kent, England, on the Medway. It has a public school (founded 1553), and manufactures wooden (*Tonbridge*) fancy-ware. Pop. (1931), 16,332.

TONE, Theobald Wolfe. Irish rebel; born in Dublin in 1763, died in 1798. Educated at Trinity College, he studied law in London, and was called to the Irish Bar (1789). He was an ardent sympathiser with the doctrines of the French Revolution, and, having promoted the combination of the Irish Catholics and Dissenters, he founded the Society of United Irishmen in 1791.

The discovery of his secret negotiations with France drove him to the United States (1795). He sailed for France in 1796, and became brigadier in Hoche's projected expedition to Ireland. In 1797 he served in the Bavarian army, and in 1798 he was captured on board a French squadron bound for Ireland. Brought to Dublin, and sentenced to death by a court martial, he committed suicide in prison.

TONGA. *See* FRIENDLY ISLANDS.

TONGALAND. A district of Zululand, and the northernmost district of Natal. Tongaland (or Amatongaland) is the home of the Amatonga. The country became a part of Zululand in 1895, and since 1897 has formed part of Natal. Area, 600 sq. miles; pop. 40,000.

TONGAREVA. *See* PENRHYN.

TONGKING. *See* TONQUIN.

TONGUE. The organ found in the mouth of most vertebrate animals, which exercises the sense of taste, and also assists in speech and in taking food. The name tongue is also given to very different structures in Invertebrata. In man the tongue is attached by its base or root to the hyoid bone and the lower jaw, its other extremity being free. The upper surface is convex with a fibrous middle septum, called the *raphé*. The front two-thirds of the tongue are rough, and bear the *papillæ*, which are sensitive to impressions of taste. The posterior third is smooth, and exhibits the openings of numerous mucous glands. The substance of the tongue consists of numerous muscles.

The papillæ, which cause the characteristic roughness of the tongue, are of three kinds, *circumvallate*, *fungiform*, and *filiform*. The largest or circumvallate papillæ number from eight to ten, and occupy the posterior part of the upper surface. They vary from $\frac{1}{20}$th to $\frac{1}{12}$th inch in diameter. The fungiform papillæ are scattered irregularly, the filiform over the front. In structure the papillæ are like those of the skin, and contain capillary vessels and nervous filaments. Numerous *follicles* and *mucous* or *lingual* glands exist on the tongue, the functions of these latter being the secretion of mucus.

The nervous supply is distributed in the form of three main nerves to

each half of the organ. The *gustatory* nerves and the *glossopharyngeal* branches are the nerves providing the tongue with common sensation, and also with the sense of taste; while the *hypoglossal* nerve carries to the muscles of the tongue the necessary stimuli for contraction.

The conditions necessary for the exercise of the sense of taste are, firstly, the solution of the matters to be tasted; secondly, the presence of a special gustatory nerve; and thirdly, that the surface of the tongue itself be moist. The top and edges of the tongue are more sensitive to taste than the middle portion. The sense of touch is very acute in the tongue.

TONIC. In medicine, any remedy which improves the tone, or general condition, of the body tissues. There are two main groups of medicinal tonics; (1) those which act by increasing the secretion of gastric juice, and thus improve the digestive powers, such as the various bitters, of which the chief are *gentian, quassia, calumba, nux vomica,* and *cinchona*; and (2) those which act through the blood-stream, as the numerous preparations of *iron,* certain *mineral acids,* and *salts.*

TONIC SOL-FA NOTATION. In music, a system of notation which has come into extensive use among the English-speaking population of the globe, chiefly through the untiring efforts of the Rev. John Curwen (q.v.), who obtained the leading features of his plan from Miss Glover of Norwich. The following is an outline of the system: As of the two relations of musical sounds, those of pitch and key (*see* STAFF), the latter is of transcendent importance, every means should be taken to impress this fact on the mind and ear of the learner.

Any diatonic scale is a natural scale, whether it is founded on the key of C, D, E, or on any other tone thus represented by a letter-name in the ordinary notation. The tonic or key-note of the scale is always called **doh,** the second **ray,** the others **me, fah, soh, lah, te,** successively, no matter what the absolute pitch of the sound may be, the initials only being ordinarily used in printed music: thus **d, r, m, f, s, l, t.** To designate a sound of absolute pitch, the tonic-solfaist uses the first seven letters of the alphabet just as the followers of the other musical system do.

Time and accent are marked thus, |:|, or |::|, or |:.:|, etc.; the space between the lines and dots indicating the aliquot parts of the bar (the beat or pulse), the line showing the strong accent, the short line the medium accent, and the colon the weak accent. Accidental or chromatic tones are indicated by a change in the vowel sounds of the syllables; thus, **doh, ray, fah,** etc., when sharpened become **de, re, fe,** etc.; and **me, te,** etc., flattened become **ma, ta,** etc. The higher octaves are marked **d'**, **r'**, **m'**, etc., the lower **d_1**, **r_1**, **m_1**, etc. The last two lines of the psalm tune *French* would therefore be printed thus:

Key F.

:s|d':t|l:s|s:fe|s:m|r:d|d:t_1|d

In teaching the system great use is made of the *modulator,* a chart which represents pictorially in an upright position the relative places of the notes of the scales, the chromatic notes, the closely related scales, etc.

The tonic sol-fa method of teaching singing is in principle a return to the ancient *movable do* system attributed to Guido Aretino (q.v.). The teacher of sol-fa trains the learner to appreciate and store in his memory the characteristic *mental effect* of each note of the diatonic scale; this mental effect depends almost entirely on the position of the notes in the scale relative to the tonic, and hardly at all on their absolute pitch.

It must be remembered that there is an essential difference between the sight-reader's and the player's method of using a system of musical signs. The player is directed to execute a certain mechanical operation, and even if his "ear" is defective, he may become a fairly competent performer. To the singer, on the other hand, mental effect, or "ear," is everything; he cannot (in general, at least) make his vocal chords sound a given number of vibrations at will.

It is therefore a very valuable feature of tonic sol-fa that it makes use of mental effect, and appeals directly to the singer's feeling for *relative* pitch. And there are other advantages in the system, from the point of view of the teacher and learner of singing, notably its simple way of dealing with modulation, or change of key. The immense advance in the quality of choral singing in Britain, and the greatly increased diffusion of musical knowledge, are undoubtedly due in very large measure to the introduction of Curwen's system.

TONKA (or **TONGA**) **BEAN.** The fruit of the *Dipterix odorāta* or *Coumarouna odorāta,* a shrubby plant of Guiana, nat. ord. Leguminosæ, sub-order Papilionaceæ. The fruit is an oblong, dry, fibrous, drupe containing a single seed. The odour of the kernel is extremely agreeable. It is used in

perfumery. Called also *Tonkin-bean, Tonquin-bean.*

TONNAGE. *See* SHIPBUILDING.

TONNAGE AND POUNDAGE. Duties formerly imposed in England on exports and imports. Tonnage was a duty upon all wines imported. Poundage was an *ad valorem* duty of 12*d.* in the pound on all merchandise imported or exported. They were first levied by agreement, and were granted by Parliament to the Crown for a limited period in 1370. They were afterwards granted to successive sovereigns until 1787, when they were finally abolished by 27 Geo. III., c. 13.

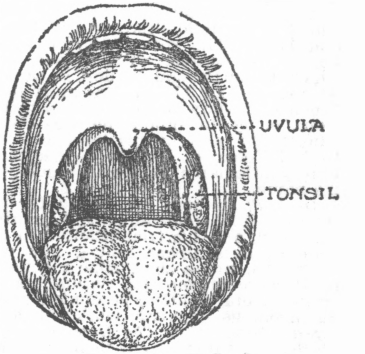
TONQUIN. The northern portion of French Indo-China. Formerly a province of Annam (q.v.), it became a French protectorate in 1884. Till 1897 the King of Annam was represented by a viceroy, but in that year a French residency was created. The area is 40,530 sq. miles, and the pop. 6,850,453 (including 6332 Europeans). The chief town is Hanoi, which since 1902 has also been capital of Indo-China. Haiphong is the chief port. Rice, maize, arrowroot, coffee, sugar, teak, raw silk, tin, coal, etc., are the main products and exports.

TONQUIN, GULF OF. An arm of the South China Sea, between the Kwangtung Peninsula and the Island of Hainan and the Annam coast. It is 300 miles long.

TÖNSBERG (tunz′ber*h*). The oldest town in Norway (founded 871), on the Drammen-Skien State Railway and Christiania Fjord. It is a considerable shipping centre to which the bulk of the Norse sealing-fleet belongs, which leaves there every March for the Polar Seas. Pop. (1930), 11,997.

TONSILS. Two masses of lymphoid tissue, situated on each side of the fauces or throat. Each tonsil lies in a depression on the side of the throat, and is partly embedded in the tissues and partly raised above the surface. They vary much in size, and in children are usually much larger than in adults. Large tonsils cause interference to satisfactory breathing and swallowing, and are always a possible source of infection and seat of inflammation (*tonsillitis*). When the tonsils are large, or when they become infected, they should be removed, and this is most effectively done in early childhood.

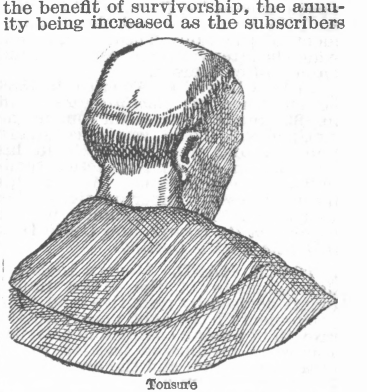
TONSURE (Lat. *tondēre*, to shear). The name given to the bare place on the heads of the Roman Catholic and Greek priests, formed by shaving or cutting away the hair. The custom of cutting away the hair in token of the dedication of a person to the service of God is mentioned as early as the fourth century. Many religious orders (for example, the Franciscans) allow only a narrow strip of hair around the head to grow; all above and below is shaved.



The Position of the Tonsils

View inside the mouth with normal tonsils. These, when diseased, may become much enlarged.

TONTINE. A kind of life annuity, so called from their inventor, Lorenzo Tonti, an Italian of the seventeenth century. A tontine is an annuity shared by subscribers to a loan, with the benefit of survivorship, the annuity being increased as the subscribers



Tonsure

die, until at last the whole goes to the last survivor, or to the last two or three, according to the terms on which the money is advanced. By means of tontines many Government loans were formerly raised.

TOOKE, John Horne. British politician and philologist, son of John Horne, a rich poulterer; born in

Westminster in 1736, died in 1812. He was educated at Westminster and Eton, afterwards proceeding to St. John's College, Cambridge. In 1760 he entered the Church and obtained the living of New Brentford.

A close friendship with Wilkes ended in a public altercation in 1770 and 1771. The year 1771 also witnessed his contest with Junius, in which, in the general opinion, he came off victor. In 1773 he resigned his benefice to study for the Bar (to which from being in orders he was not admitted); and by his legal advice to Mr. Tooke of Purley, he became that gentleman's heir, and assumed his name.

In 1777 he was prosecuted for a seditious libel condemning the American War, and his trial resulted in a year's imprisonment and a fine of £200. He was a short time member of Parliament for Old Sarum. He wrote several political pamphlets and an ingenious linguistic work entitled *Epea Pteroenta, or The Diversions of Purley*. A tablet to his memory was unveiled at Ealing (St. Mary's Church) in 1919.

TOOLE, John Lawrence. British comedian, born in London 1833, died in 1906. Educated at the City of London School, he was employed as a clerk for some time, but subsequently took to the stage, and made his first appearance at the Haymarket in 1852. In 1880 he commenced the management of the Folly Theatre, London, which he afterwards reconstructed and named after himself.

In 1874 he visited America, in 1888 he published his *Reminiscences*, and in 1890 made a successful tour in the Antipodes. Toole was exceedingly popular, and was inimitable in his personation of semi-pathetic, semi-ludicrous characters. Among his most successful impersonations were Paul Pry, Caleb Plummer in the *Cricket on the Hearth*, and Uncle Dick in *Uncle Dick's Darling*.

TOOLS, HAND. Modern tools are developments of the crude implements devised by primitive man. Improvements have kept pace with the growth of human energy and activity. Increased production has led to increased demand, and the evolution of the most efficient appliances has been only a question of time. The form of any particular appliance has been dictated by considerations of convenience in handling, and by the physical properties of the material worked upon. Advances in metallurgy, such as the introduction of new steels for specific purposes in the arts, have naturally reacted on tool manufacture.

The processes dealt with in hand operations are sawing, shaping to desired form by simple cutting operations, and smith forging on an anvil. In addition to these, which have reference solely to the production of definite shapes in wood, metal, or other material, there are many other activities in the arts, such as the use of the trowel in building operations, the production of joints in lead pipes and struts, the cutting and welding of iron and steel by gas or with the electric arc, which are also to be classed as manual operations.

Saws. For cutting down growing timber, saws of the chain type, with the toothed elements mounted by pin connection with each other, or of the double-handed flat-bladed type, are in common use. In simple carpentry and joinery, hand saws with a slightly tapered width of blade and having teeth suited either for cutting across or with the grain of the timber are available. The shapes of the teeth of cross-cut and hack saws are necessarily different to suit the conditions of their employment.

The teeth of a saw blade are turned alternately to each side, and thus the width of the groove cut is always greater than the width of the saw blade. In metal working a narrow steel blade with teeth on one edge is gripped in a simple steel frame provided with a handle. Blades of even smaller widths, going down to the narrowest steel ribbon, are used in fretwork, and for that purpose must also be clamped in a frame to keep the blade taut.

Wood-working *chisels* may be of the simple cutting type with wide flat backs, or in the curved form as *gouges*. The ordinary flat chisel is operated by simple hand pressure, but for mortising, hammer operation is common, and the blade must, in consequence, be made of much thicker material.

A process common in the fitting work of an engineering establishment is the reduction of material to size by chipping. For this purpose a heavy chisel made of round bar with the nose shaped into a tapered and flat-sided form is the common tool. In the process of using this tool, it is held in position and driven slightly into the material, turning up a ridge on the surface. The tool is then set to an angle suited to the depth of working, which only practice will show, and a strip of metal is hammered away from the material in small lengths. The irregularities on the surface of the job may be removed after the chipping is completed by the process known as filing.

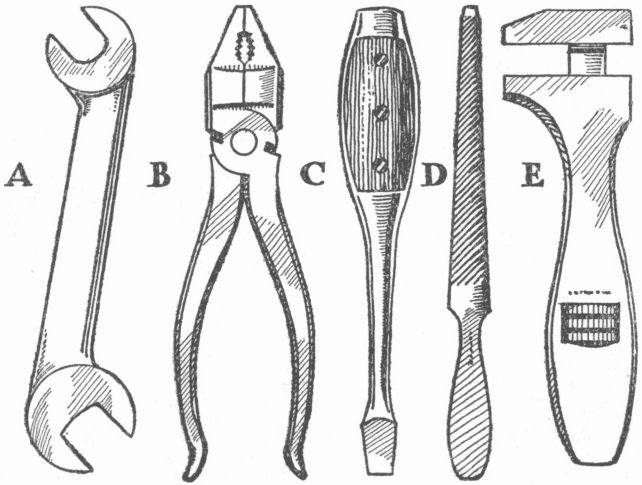
Files have teeth cut across their

surfaces, which tear away the upstanding material as they are driven by hand pressure across the work. The widths and depths of the teeth give an index to the class of work for which the file is suited, and range from bastard to smooth.

Hand *braces* are available for drilling small holes. The *bits* used for wood-working may, like the *centre* bit, have a centre prong, a cutter point just a little shorter, and a curved blade to get under the material and clear it away; or be formed with a helical groove on its length, or with a coned rose point, as in the countersinking type.

Metal, such as constructional steel, can also be drilled by the use of the hand tool known as the *ratchet brace*. In this case a back support for the tool is required to deal with the thrust, and the feed is given to the screwed extension of the drill chuck by a nut, which receives motion on its stepped outer surface from a pawl. Similar but lighter tools are available for wood-working, but the thrust is then taken by the body of the workman. Screw threads are made in holes with tapered *taps* of tool steel with teeth cut on them, and *dies* are available for use in *stocks* on similar work on rods.

By heating and hammering, wrought iron may be shaped to almost any desired form. The *anvil* provides a flat surface for working on, as well as a conical nose, which is useful in shaping circular openings in work or bending the metal to the desired curves. Shaped formers and what is termed a *swage block*, having holes of various dimensions and shapes, are useful in the production of many classes of smith-work.



Tools: A, Double-ended set spanner. B, Wire-cutting pliers. C, Screw-driver. D, File. E, Adjustable spanner.

TOON, or TOONA. The wood of an East Indian tree, the *Cedrēla Toona*, nat. ord. Cedrelaceæ. It is sometimes called *Indian mahogany*, and also *Indian cedar*. Another species (*C. australīlis*) yields the so-called cedar-wood of New South Wales. Toon-wood is highly valued as a furniture wood, and is used for door-panels, carving, etc. *See* CEDRELA.

TOOWOOMBA. The chief town of the Darling Downs district of Queensland, Australia, 100 miles west of Brisbane. It is the centre of a large agricultural settlement. Pop. (1931), 26,439.

TOPARE (formerly **Pollanarrua**). A ruined city of Ceylon, about 50 miles north-east of Kandy, the Sinhalese capital between A.D. 770 and 1235. There is an enormous wall and many other relics.

TOPAZ. A mineral, ranked among gems; lustre vitreous, transparent to translucent; colour yellow, white, green, blue; fracture subconchoidal,

uneven; perfect basal cleavage; specific gravity 3·5. It is harder than quartz. It is a silicate of aluminium, in which the oxygen is partly replaced by fluorine. It occurs massive and in crystals. It crystallises in orthorhombic prisms, terminated by pyramid planes at one end and a basal plane at the other.

Topazes occur generally in igneous and metamorphic rocks, and in many parts of the world, as Cornwall, Scotland, Saxony, Siberia, Brazil, etc. The finest varieties are obtained from Brazil and the Ural Mountains. Those from Brazil have deep yellow tints; those from Siberia have a bluish tinge; the Saxon topazes are of a pale wine-yellow; and those found in the Scottish Highlands are of a sky-blue colour.

TOPE (*Galeus vulgāris*). A European fish of the shark kind, attaining a maximum length of 7 feet. It possesses a nictitating membrane and three rows of triangular saw-edged teeth. The species is viviparous.

TOPE'KA. A city of Kansas, United States, the state capital and the county seat of Shawnee county, on Kansas River; served by the Atchison, Topeka, & Santa Fé Railroad. There are flour-mills, iron-foundries, a rolling-mill, machine-shops, brick-kilns, breweries, and railway shops. Founded in 1854, it became state capital in 1861, and a city of the first class in 1881. Pop. (1930), 64,120.

TORGAU. A town of Germany, in the Prussian province of Saxony, on the Elbe; a junction for Pratau on the Halle-Kottbus railway. Pop. 13,550.

TOR'MENTIL (*Potentilla tormentilla*). A trailing plant common in Britain in heathy or waste places. *See* POTENTILLA.

TORNA'DO. The most violent and destructive of all storms. A tornado is distinguished by the funnel-shaped cloud that extends downwards from the storm-cloud to the earth, and moves forward, with a noise like prolonged peals of thunder, at the rate of about 40 miles per hour. The speed is rarely below 30 miles per hour, and the diameter of the storm averages only about 1000 feet. Where a tornado crosses open water a waterspout is formed.

The atmospheric disturbances which are denoted by the word tornado are more or less peculiar to the United States, where they are confined to the plains of the south, and especially to the Missouri and Mississippi basins. Spring and summer are the prevalent seasons, tornadoes being hot-weather phenomena; and the afternoon, between 3 and 5.30 p.m., is the general time of occurrence.

The passage of the spiral cloud is accompanied by violent thunderstorms and heavy rain, and hail frequently falls in its wake. Meteorological observations and records of tornadoes are more or less impossible, since, within the diameter, men are lifted up like straws and generally dashed to death; and within the storm, pressure being reduced to three-quarters or even half its normal value, everything is made to burst with explosive violence.—Cf. A. E. M. Geddes, *Meteorology*.

TORNIO (Sw. *Tornea*). A river of North-Western Europe, rising in Sweden and flowing to the head of the Gulf of Bothnia; length, 250 miles. The Lower Tornio forms the Swedo-Finnish frontier.

TORNIO. A seaport-town of Finland, in the department of Uleaborg and Petsamo, at the mouth of the Tornio River, opposite Haparanda (Sweden), with which there is a bridge connection. It is the frontier-head of the important international railway (4·9-foot gauge) to Leningrad, which all goods and passengers make use of when entering Russia (from the west) in normal times. Pop. 2500.

TORO. (1) A town of Spain, in the province of Zamora, on the Douro; served by the railway Zamora-Medina del Campo (56 miles). Woollens, leather, and wine are made. Pop. 7540. (2) A town of Spain, in the province of Castellon; stands near the Calatayud-Valencia railway.

TORO. The northern district of the Western Province of Uganda extending roughly north and south between Lakes Albert and Edward and including the Uganda zone of the Semliki Valley, part of Ruwenzori and nearly the whole of Lake George (3015 feet altitude; area, 114 sq miles), which is connected by Kazinga Channel (the southern boundary of Toro) with Lake Edward.

Low hills and swamps characterise the Buganda frontier zone, but merge in the east-central plains of short grass studded with verdurous hills which, crossed in the west by a dense ribbon of elephant- and buffalo-haunted jungle, extends unbroken to the slopes of Ruwenzori. From Lake George with its tsetse-infested shore the surface rises to the north-eastern extension of Ruwenzori, the Portal Peaks (14,000 feet), behind which is the Mwenge zone, an open plain with occasional papyrus swamps, that descends rapidly as the Nkussi River is approached.

The whole region possesses many

relics of intense seismicity and vulcanicity, including a wealth of crater-lakes filled with warm blue water, hot springs on the flanks of Ruwenzori, and upstanding volcanic plugs and necks innumerable. The Mpanga is the chief river, and, with the Hima and Rivimi, flows to Lake George. All three rise in Ruwenzori. Fort Portal (5299 feet) is the head-quarters (mean annual temperature, 68·1° F.; March mean, 69·7° F.; October, 66·4 F.; mean annual rainfall, 55·4 inches.

Toro is an autonomous kingdom ruled by a *Mukama*, through a *Katikiro* (Prime Minister) and *Lukiko* or council of *saza* chiefs, each of whom presides over one of the ten *sazas* into which Toro is subdivided. Hematite is mined and worked to a limited extent by the natives, but the chief occupations are cattle-, sheep-, and goat-tending, and the raising of millet, peas, beans, sesame, groundnuts, manioc, bananas, maize, dhal, some tobacco, and a little coffee. Little or no cotton is grown. There are large forests (chief tree ironwood, *Cynometra Alexandri*), and many species of game (chimpanzee, Colobus monkey, elephant, situtunga, and waterbuck) are found.

TORON'TO. A city of Ontario, Canada, in York county, the provincial capital, and the second city and educational centre of the Dominion. It is 333 miles from Montreal by rail, and is served by the two great transcontinental lines (Canadian Pacific and National), and by steamers plying on Lake Ontario, along a bay of which the city extends for 10 miles. The harbour accommodation is in course of improvement.

The University of Toronto (about 5500 students) has faculties of arts, science, medicine, applied science and engineering, forestry, education, music, and household science, and is one of the best-equipped in all America. Queen's Park, adjoining the university (area, 1700 acres), contains a fine legislative building.

Toronto receives electric power from Niagara Falls, and its hydro-electric undertakings are the most comprehensive municipal-supply schemes in America. The street railways were taken over by the municipality in 1921. Industries include: engines and machinery, cars and carriages, furniture, ironmongery, agricultural implements, etc.

The Canadian National Exhibition is held there annually in September in permanent buildings, over a million persons attending it. It is a great centre of banking and insurance, and leads the Canadian publishing industry. Toronto was founded in 1794 and was first named York. Its growth has been phenomenal. Pop. in 1881, 86,415; in 1891, 181,215; in 1901, 208,040; in 1908, 287,201; in 1931, 627,582.

TORPE'DO. The name of fishes allied to the rays, family Torpedinidæ, and noted for their power of giving electrical shocks. The electrical organs consist of two masses placed on each side of the head, composed of numerous gelatinous columns separated by membranous septa, and richly furnished with nervous filaments.

Their production of electricity is explicable on the ground of the conversion of nerve force into electric force by the electric organs; just as nerve force is converted into motion through the muscles. The species of the type genus Torpedo occur chiefly in the Mediterranean, Red Sea, and in the Atlantic and Pacific Oceans. A large specimen may measure 4 feet long, and weigh from 60 to 70 lb.

TORPEDO In naval warfare, a case or shell containing explosive material, and capable of being propelled under water so as to explode when it comes into violent contact with the hull of a hostile ship. Early forms were controlled electrically or mechanically from the shore or ship by means of wires. One example of this type, the Brennan, which is still in use for harbour defence, is fitted with two drums of fine steel wire, which are unwound by an engine on shore, and communicate their rotation to propelling screws.

The modern uncontrolled torpedo is the invention of Robert Whitehead (1823-1905), a British engineer who settled in Fiume in 1856. Its essential features are the provision of internal power and machinery for maintaining speed and preserving direction. The shape of the torpedo, and the arrangement of its main internal elements, are shown in the diagram (fig. 1). The *head* C contains the *charge* D of T.N.T., which, when the *pistol* A strikes a target, becomes ignited, with the help of a detonator of fulminate of mercury and a priming charge in the *primer* B. The *air-vessel* E contains the compressed air which gives the torpedo its motive power. The compartment F, the *water-bottle*, shuts off the air-vessel from the engine and air-heating apparatus. G is the *charging-valve*, and H the *stop-valve*, in the main air-pipe. J is the engine, and I is the *air-lever*, by means of which it is started (cf. fig. 2, at D).

The depth-keeping mechanism consists of the *pendulum weight* K, and the *hydrostatic valve* L, which by their joint action operate the horizontal

rudder S, with the help of the small air-engine O, called the *servomotor*. M is the *fuel-bottle*, and N the *generator*; the purpose of these is to heat the compressed air, and so increase its pressure before it enters the engine. P is the *buoyancy chamber*, Q the *propellers*, and R the *gyroscope*, which, if the torpedo suffers any deflection, tends to preserve its plane of rotation, and therefore so acts on the *vertical rudder* T as to restore the torpedo to the correct course.

The chief parts of the *tube*, from which the torpedo is discharged, are indicated in fig. 2. The Brotherhood engine, of the 3- and 4-cylinder types, has a notable record of service in the

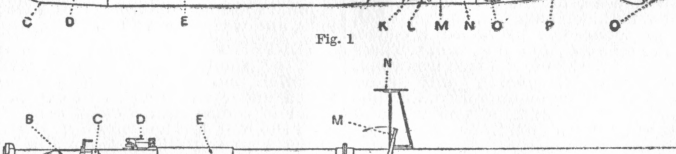


Fig. 1

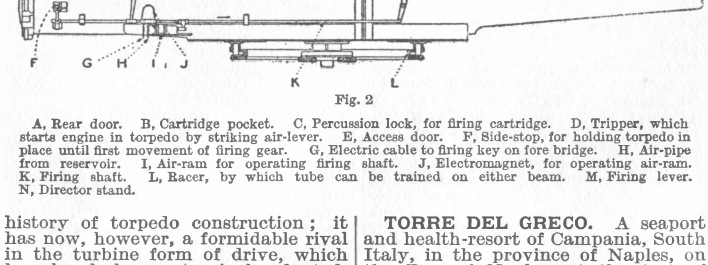


Fig. 2

A, Rear door. B, Cartridge pocket. C, Percussion lock, for firing cartridge. D, Tripper, which starts engine in torpedo by striking air-lever. E, Access door. F, Side-stop, for holding torpedo in place until first movement of firing gear. G, Electric cable to firing key on fore bridge. H, Air-pipe from reservoir. I, Air-ram for operating firing shaft. J, Electromagnet, for operating air-ram. K, Firing shaft. L, Racer, by which tube can be trained on either beam. M, Firing lever. N, Director stand.

history of torpedo construction; it has now, however, a formidable rival in the turbine form of drive, which has already been extensively adopted. The torpedoes used in the British navy are 18 inches and 21 inches in diameter, the smaller size for use in coastal motor-boats, submarines, and aircraft; the larger for use in capital ships, light-cruisers, and destroyers.

In the European War the torpedo played an important part, especially in the hands of the German submarine commerce destroyers (*see* U-BOAT). In the battle of Jutland the German fleet sustained considerable damage from torpedoes, and was successful in obtaining one or two hits on our ships. Seaplanes carrying torpedoes were used to some extent during the war, and seem likely to play a more important part in the future.

TORPEDO-BOAT DESTROYER. *See* NAVY; SHIPBUILDING (NAVAL).

TORQUAY (tor'kē). A municipal borough, seaport, and watering-place of Devonshire, England, on Tor Bay. Its mild winter climate attracts many visitors, and there are theatres, baths (including tonic baths), and a promenade pier, as well as golfing, yachting, and sea-bathing facilities. Pop. (1931), 46,165.

TORRE ANNUNZIATA. A seaport of Campania, South Italy, in the province of Naples. It lies on the Bay of Naples, at the foot of Mount Vesuvius, from the eruptions of which it has often suffered. Pop. 40,000.

TORRE DEL GRECO. A seaport and health-resort of Campania, South Italy, in the province of Naples, on the Bay of Naples, at the foot of Mount Vesuvius. There are ship-building-yards, stone-work industries, etc. Pop. 45,000.

TORRENS, LAKE. *See* SOUTH AUSTRALIA.

TORRES STRAIT. The strait which separates Australia from New Guinea, being about 80 miles across. It is crowded with islands, shoals, and reefs, rendering its navigation difficult. Pearls, pearl-shell, and beche-de-mer are found and extensively worked.

TORRES VEDRAS. Town in Portugal. It is 40 miles by rail from Lisbon. Near here, during the Peninsular War, Wellington constructed the famous fortifications known as the "Lines of Torres Vedras," which he successfully

defended during the winter of 1810. Pop. (1930), 26,040.

TORRICELLI (tor-ri-chel'lē), **Evangelista.** Italian physicist, born in 1608, died in 1647. He owed much to the inspiration of Galilei, whom he succeeded as professor of mathematics in the Florentine Academy. Torricelli was the discoverer of the method of obtaining a barometric column by filling a glass tube with mercury and inverting it under the same liquid. The fact that the mercury did not fall in the tube he explained as an instance of the principle that nature abhors a vacuum. The true explanation was first given by Pascal. *Torricelli's Theorem* in hydraulics (q.v.) gives the velocity of efflux of liquid from an orifice.

TORRIDON. Village and sea loch of Scotland. The village stands on the loch, which is an opening of the sea into the W. coast of the county of Ross and Cromarty.

TORRINGTON. A municipal borough of Devonshire, England, on the Torridge. Glove-making is the principal industry. Pop. (1931), 2913.

TORRINGTON. A town of Connecticut, United States, in Litchfield county; served by the New York, New Haven, & Hartford Railway. It is an industrial town founded in 1734. Pop. (1930), 26,040.

TOR ROYAL. Devonshire residence of the Prince of Wales. It is near Princetown.

TORSION BALANCE. An apparatus used by Coulomb in France, first to determine the laws of torsion or twisting of wires; it was then used by Coulomb to prove the law that the force of attraction or repulsion between two magnetic poles varies inversely as the square of the distance between the poles. It was also employed in proving the corresponding law relating to electric charges. These are known as Coulomb's laws.

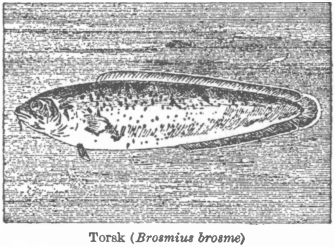
In the last case, the two charges were carried on two equal insulated metal balls; one of these was held at the end of an arm suspended horizontally by means of a thin vertical silver wire; the other was carried on a fixed vertical support, all being enclosed in a glass case. A charge on one ball was shared between the two, and the distance between the balls could be given different values by turning the torsion head. In order to reduce the distance between the balls to one-half, the torsion had to be increased four times. Hence followed the inverse square law.

TORSION METERS. The rate of working of a steam-engine may readily be determined by the use of an indicator (q.v.). In a steam turbine the same purpose is served by the torsion meter. When power is being transmitted through a shaft, a certain twist is produced in it, the magnitude of which depends on the material and the torque. This principle admits of application in the case of steamships propelled by steam turbines, but as the twist is not considerable, it must be measured over as great a length as possible.

In the usual arrangement two sleeves are clamped to the propeller shaft at the standard distance apart. They are arranged so that their free ends are brought together for the purpose of comparison. As the sleeves revolve with the shafting, simple observation of the twist is not possible. The reflected light from mirrors connecting the two sleeves serves to show the magnitude of the torsion in one system. In another, brushes on a series of small commutator bars give the means of finding the desired information.

The torsion meter is a useful instrument available for other power measurements than those of ship propulsion. It is manufactured in standard sizes for various types and sizes of work.

TORSK (*Brosmius brosme*). A fish of the cod family, found in great quantities off the Orkney and Shetland Islands, where it constitutes a



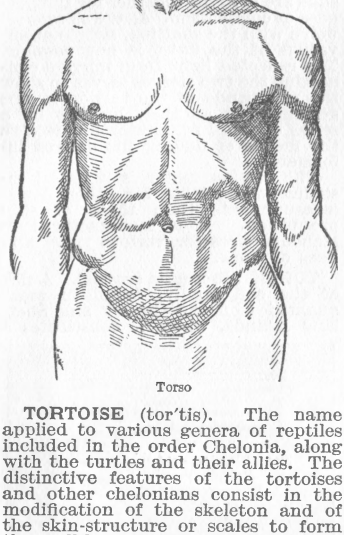
Torsk (*Brosmius brosme*)

considerable article of trade. The species ranges north to Spitzbergen, and south to Cape Cod on the American coast. It is, when salted and dried, a savoury stock-fish. It is from 18 to 30 inches long, and is called also *tusk*.

TORSO (It.). An art term signifying the trunk of a statue of which the head and the extremities are wanting. The *torso* of Heracles, in the Belvedere at Rome, is considered by connoisseurs one of the finest works of art remaining from antiquity. It is a masterpiece of the later Greek sculpture, and is the work of Apollonios, son of Nestor, an Athenian. See illus. p. 262.

TORSTENSON, Lennart. Swedish general, born 1603, died 1651. He distinguished himself in the Thirty Years' War, being appointed leader of the Swedish army in Germany in 1641, and having command of it for five years.

TORT, in law, denotes injustice or injury. Actions upon torts or wrongs are all personal actions for trespasses, nuisances, assaults, defamatory words, and the like.



Torso

TORTOISE (tor'tis). The name applied to various genera of reptiles included in the order Chelonia, along with the turtles and their allies. The distinctive features of the tortoises and other chelonians consist in the modification of the skeleton and of the skin-structure or scales to form the well-known bony box in which their bodies are enclosed, the upper portion of which is the *carapace*, the lower the *plastron*.

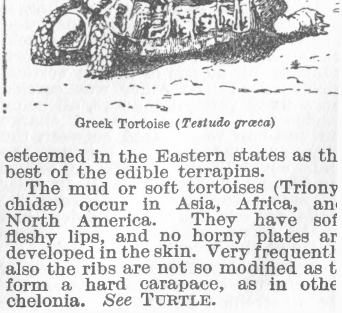
The Testudinidæ include the typical land-tortoises, and have short stunted limbs adapted for terrestrial progression; the short toes are bound together by the skin, and have well-developed nails. The carapace is strongly convex, and is covered by horny epidermic plates. The horny jaws are adapted for cutting, or may be divided into serrated processes. The head, limbs, and tail can be completely retracted within the carapace.

Though capable of swimming, the tortoises proper are really terrestrial animals, and are strictly vegetable feeders. The most familiar example is the common Greek or European tortoise (*Testūdo græca*), which is frequently kept as a household pet. It occurs chiefly on the eastern borders of the Mediterranean.

These animals sometimes live to a great age (over a hundred years according to some), and hibernate through the colder season of the year. They attain a length of 12 inches. The gopher tortoise (*T. polyphemus*) is native to the south-east of the United States; and another species (*T. tabulata*) is widely distributed through tropical South America. Gigantic species are found in the Galapagos Islands and some of the islands in the Indian Ocean.

The box tortoises (Cinixys) are remarkable for the curious development of the front part of the plastron, which shuts over the anterior aperture of the shell like a lid when the animal retracts itself. Species are found in tropical Africa. In the box tortoise of North America (*Cistūdo carolīna*) the hinder part of the plastron forms a lid.

The family Testudinidæ also includes aquatic forms, including the American water-tortoises or terrapins (Chrysemys) that range from Canada to the Argentine; the European pond tortoise (*Emys orbicularis*), with a related species (*E. blandingi*) in North America; the Iberian water-tortoise (*Clemmys leprosa*), ranging into North Western Africa, with allied species in the Balkans and Asia Minor, and also in North America; and a North American type (Malacoclemmys), of which one species (*M. terrapin*) is



Greek Tortoise (*Testudo græca*)

esteemed in the Eastern states as the best of the edible terrapins.

The mud or soft tortoises (Trionychidæ) occur in Asia, Africa, and North America. They have soft fleshy lips, and no horny plates are developed in the skin. Very frequently also the ribs are not so modified as to form a hard carapace, as in other chelonia. *See* TURTLE.

TORTOISE-SHELL. A name popularly applied to the shell or rather the scutes or scales of the tortoise and other allied chelonians, especially to those of the *Chelonia imbricāta* (the hawk's-bill turtle), a species which inhabits tropical seas. The horny scales or plates which form the covering of this animal are extensively used in the manufacture of combs, snuff-boxes, etc., and in inlaying and other ornamental work. It becomes very plastic when heated, and when cold retains with sharpness any form it may be moulded to in its heated state. Pieces can also be welded together under the pressure of hot irons. It is now largely imitated by horn and cheap artificial compounds.

TORTOISE-SHELL BUTTERFLY. A name given to two British butterflies, the small tortoise-shell (*Vanessa urtīcæ*) and the large tortoise-shell (*V. polychloros*), from the colouring of the wings.

TORTO'LA. The chief island of the British possessions in the Virgin group. It contains Road Town (pop. 463), the group capital.

TORTO'NA. A town of Piedmont, Northern Italy, in the province of Alessandria. Pop. 20,150.

TORTO'SA. A walled city of Tarragona, Spain, on the Ebro. There is a cathedral (1347), and ruins of a Roman city. Pop. 33,000.

TORTU'GAS, or **DRY TORTUGAS.** A group of ten small low barren islands belonging to Florida, United States, about 40 miles west of the most westerly of the Florida Keys. On Loggerhead Key there is a lighthouse.

TORTURE. The use of torture to extract evidence from accused persons goes far back in legal history, and has completely disappeared only in comparatively recent times. It existed under Roman law (although it was not until the period of the Empire that freemen could be treated in this way), and from Roman law it spread into the legal systems of Mediæval Europe, its use rapidly extending after the "reception" of Roman law in continental Europe in the later Middle Ages. It was also, and at an earlier date, employed by the Inquisition (q.v.) in cases of heresy, which was regarded by the Church as the equivalent of the crime of treason, and, therefore, as justifying the employment of any method of ascertaining the truth.

The law of England (which never accepted the Roman civil code) was, on the whole, honourably free from this species of barbarity, and Sir John Fortescue, Chief Justice of King's Bench in the fifteenth century, praised the laws of England on the ground that they refused to permit this expedient. There was, however, one recognised form of procedure, known as *peine forte et dure* (q.v.), which involved torture.

A prisoner who refused to plead to an indictment for felony and to utter the required formula that he desired to be tried "by God and my country" was liable to be loaded with iron weights and to be pressed to death, and this ferocious rule was not abolished until 1772. There is, however, an important distinction between forcing a man to plead to an indictment and compelling him, under torture, to answer questions designed to entrap him into admissions of his own guilt, or into accusations against his real or supposed accomplices and other suspected persons.

The latter procedure was not employed in English law before the accession of the House of York, and, in the trial of the Templars in 1309, Edward II. at first refused to allow its use, but gave way when Pope Clement V. insisted that no national custom could be allowed to override the canon law. But in the reign of Edward IV. torture was introduced as a judicial process, and though it was never in England, as it was elsewhere, part of the procedure of the ordinary courts, it was freely used by the Privy Council and, later, by the Star Chamber.

The Tudor reigns were the most notorious period of the employment of torture in England, but there were also instances in the seventeenth century, although in 1628 the judges declared that it was illegal to torture an accused person in order to compel him to reveal his accomplices. In Scotland the use of torture was earlier and more frequent, and reached its climax in the seventeenth century, during which it was an ordinary method of examining both State prisoners and witches.

It is specially identified with the administration of the Duke of York in the reign of Charles II., and with the persecutions of the Covenanters, and in the Scottish Claim of Rights (1689) "the using of torture without evidence or in ordinary crimes" was described as illegal; the absence of such a clause in the English Declaration of Rights shows the difference of practice in the two countries.

Even after the Revolution, the use of torture to extract evidence was permitted in special cases by the Scottish Parliament in the reign of William and Mary. The most common instruments of torture for the purpose of obtaining evidence were

the rack (used everywhere in Europe), the boot, and the thumb-screw; the last mentioned is specially associated with the persecution of the Scottish Covenanters.

Torture was also employed as an aggravation of the capital penalty. Certain modes of execution (such as breaking on the wheel in France) were employed because of the pain they involved; burning at the stake for heresy, or for the murder of a husband, is another illustration. The horrible mutilations which accompanied a sentence of hanging for treason were inflicted in order that torture might serve as a deterrent.

Notable instances of the use of tortures as a punishment are the execution of the murderers of James I. of Scotland in 1437, and the abominable devices invented in France for the execution of Robert François Damiens, in 1757, for an attempt upon the life of Louis XV. The use of torture, both for extracting evidence and as a penalty, is now abandoned in all civilised countries.

TORUN. *See* THORN.

TORY. An English party name which originated during the Exclusive Bill debates (1679-80). It was employed in Ireland to describe native Irishmen who had been dispossessed of their lands and had become outlaws. The process by which this term came to be applied to English supporters of divine right and passive obedience is obscure. According to Defoe, the "real godfather" of the Tory party was Titus Oates, who asserted that Tories were being brought over from Ireland to murder him, and described everyone who disbelieved in the Popish Plot as a "Tory."

The name was thoroughly established by the end of the reign of Charles II., the period of the definite formation of political parties. The policy of James II., and especially his attack upon the Church of England (by interfering with the universities and prosecuting the Seven Bishops), shook the faith of the Tories in their own doctrines, and at the Revolution they joined the Whigs in bringing about his deposition, but pacified their consciences with the belief that his flight constituted an abdication.

The unpopularity of William III. and the disputes of his reign led many Tories to repent the acquiescence of their party in the Revolution, and in the reign of Anne they became favourable to the succession of the queen's half-brother, James, the "Old Pretender." In 1719, when the nation was tired of the War of the Spanish Succession, the Tories came into power on a cry of "the Church in danger," and under Oxford and Bolingbroke they used their supremacy to bring about peace with Louis XIV., the friend and protector of James, and to prepare the way for a Stewart restoration.

The death of Queen Anne occurred before their plans were matured, and, under the first two Hanoverian kings, the Tories were regarded as Jacobites and were in permanent opposition. By the date of the accession of George III. they had become reconciled to the new dynasty, and, maintaining their old custom of supporting the royal authority, they helped to form the group of politicians known as "the King's Friends."

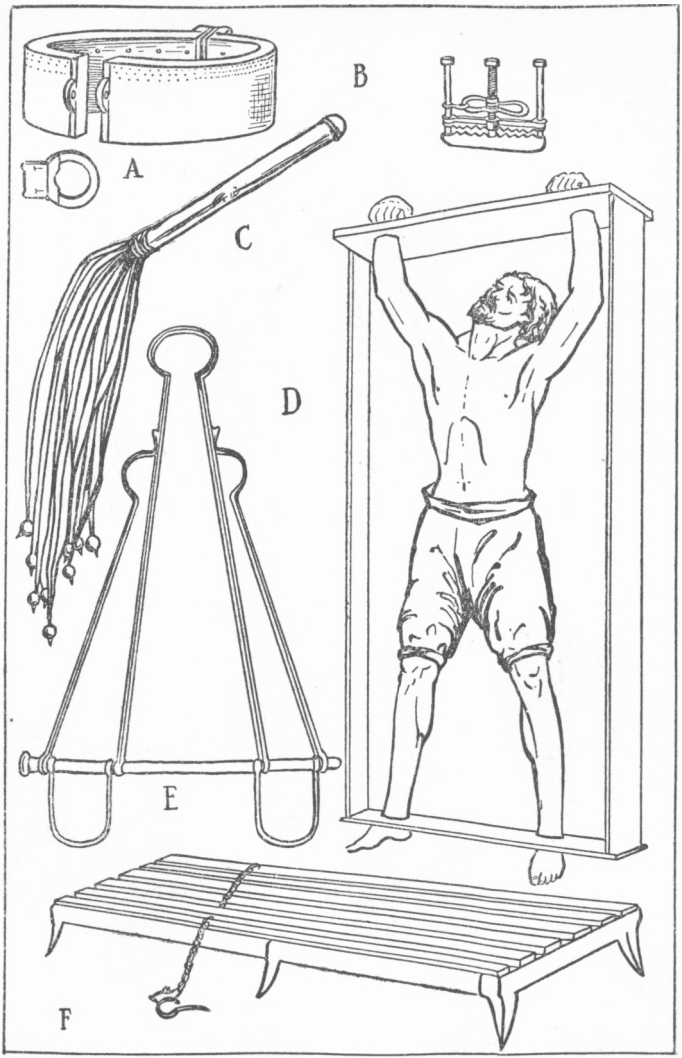
After the loss of the American colonies, the Tories, under the leadership of the younger Pitt, were becoming imbued with more liberal doctrines, but the excesses of the French Revolution put an end to this development, and until 1832 the Tories were, first, a war party, and, after 1815, a party opposed to Parliamentary reform. After the Reform Act of 1832, the name "Tory" was replaced by "Conservative."—Cf. C. R. Kent, *Early History of the Tories.*

TORY ISLAND. An island of the Irish Free State, in County Tirconaill, on Tory Sound, which separates it from the mainland. Fishing is the chief industry. Pop. 300.

TOSTI, Francesco Paolo. The popular Italian song-writer, born 1846, died 1916. He showed a definite musical bent in early years, making great progress as a student at the Royal Conservatory of S. Pietro a Majella at Naples, where his special studies were violin-playing and composition. As the result of overwork he had a serious illness at the age of twenty-three, and his first two songs, *Non m'ama più* and *Lamento d'amore*, were written during this period.

They have since become very popular; but Tosti experienced the usual difficulties of an unknown man in getting them published. Once having secured a hearing, however, he enjoyed a steadily growing recognition, and became one of the most widely appreciated writers of superior drawing-room songs. While in Italy he enjoyed the friendship of Sgambati, and taught singing to Queen Margherita.

On his first visit to London, in 1875, he was well received both as an artist and a man, and returned there yearly till 1880, when he made London his home. He was teacher of singing to the royal family, and



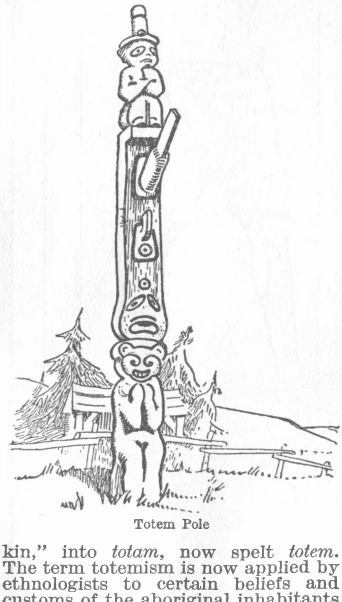
TORTURE

A, Collar. B, Thumbscrews. C, Cat-o'-Nine Tails. D, Stocks. E, The Scavenger's Daughter F, Grid-iron

received a knighthood in 1908. His songs are characterised by finely flowing melody, attractive harmony, and finished workmanship, and his best lyrics are excellent examples of the superior type of popular song.

TOTALISATOR. The registration machine on the pari-mutuel system of betting which registers the number of bets made on each race. By the Racecourse Betting Act, 1928, the totalisator was legalised in Britain, and it began to be used in 1929. When bets are made on a race they are pooled, and a fixed proportion (about 10 per cent) is deducted by the officials in charge, the remainder being distributed among the backers of the winning and placed horses. It is a common feature of Continental race-courses.

TO'TEMISM. A modified form of the word *totamism*, invented in 1791 by Long, an English trader, who transformed the native American word *oteteman*, "his brother-sister



Totem Pole

kin," into *totam*, now spelt *totem*. The term totemism is now applied by ethnologists to certain beliefs and customs of the aboriginal inhabitants of America, Oceania, Australia, Indonesia, and Africa (and in modified forms among many other peoples, ancient and modern), in virtue of which (*a*) each definite social group or clan of the community is associated with some animal (or, in other cases, plant or inanimate object) regarded as its totem, with which members of the group are believed to be genetically related, usually being regarded as its (the totem's) offspring; and (*b*) special respect is shown to the totem—if an animal or plant, it may not be eaten, except on certain special occasions, or if an inanimate object, it may not be used, or used only with certain restrictions.

There is great conflict of opinion as to the origin and significance of this remarkable culture-complex; but recent research (especially the work of W. J. Perry) has made it clear that, in whatever part of the world it is found, totemism was derived directly or indirectly from the religious beliefs and social practices of the Egyptian royal family of the Pyramid Age.

The totem animals were the tribal crests, eagle, lion, snake, etc., which were the clans' protectors and badges in warfare. The Egyptian kings were regarded as "Sons of the Sun," having been born from the Great Mother, the Divine Cow, fertilised without carnal intercourse by the sun.

The inextricable connection of the more primitive forms of totemism with the ideas of children of the sun, virgin birth, matrilineal descent from animals, and the use of protective animal crests, reveals the derivation of its essential elements from Egypt.
—BIBLIOGRAPHY: W. J. Perry, *The Children of the Sun*; Sir J. G. Frazer, *Totemism and Exogamy*; J. N. B. Hewitt, article *Totem*, in *Handbook of American Indians*.

TOTNES. A municipal borough and market town of Devonshire, England. It has a grammar-school founded in 1554. The houses, which overhang the pavements, forming covered walks, are characteristic. Pop. (1931), 4525.

TOTTENHAM. Urban district of Middlesex. It is 5¼ miles north of the city and is served by the L.N.E. and L.M.S. Railways. The buildings include Bruce Castle. Pop. (1931), 157,748.

TOTTENHAM HOTSPUR. Association football club. It was founded by some boys at Tottenham in 1882, and in 1895 became a professional organisation. It became a member of the Southern League in 1896, and in 1909 entered the League proper. In 1901 and again in 1921, the club won the Association Cup. The ground is in High Road, Tottenham.

TOUCAN (Rhamphastus). Climbing birds of the woodpecker order (Coraciiformes), family Rhampha-

stidæ. These birds inhabit the tropical regions of South America, and are distinguished by a large keeled bill. The bill is about 8 inches long, and its substance is hollowed out into air-cells, thus being comparatively light. The toucans feed on fruits, seeds, insects, etc. The prevailing colours among the toucans are yellow, black, and red. The bill is frequently of a bright colour.

Toco-Toucans (*Rhamphastus toco*)

TOUCH. The sense of feeling and the most widely diffused of the senses. It resides in the skin, and is exercised through certain structures situated in the papillæ of the true skin and connected with terminal filaments of sensory nerves. These structures have some variety of form, and are called tactile cells, tactile corpuscles, compound tactile corpuscles, Pacinian corpuscles, etc.

All the kinds are to be regarded as terminal organs of the sensory nerves, acting as the media by which impressions made on the skin are communicated to the nerve fibres. Although the sense of touch is diffused over the whole body, it is much more exquisite in some parts than in others. Experiment shows the tip of the tongue to be the most sensitive surface, the points of the fingers come next, while the red part of the lips follows in order. The neck, middle of the back, and the middle of the arm and thigh are the least acute surfaces. *See* SENSATION.

TOUCHSTONE. A variety of extremely compact siliceous schist, used for ascertaining the purity of gold and silver; known also as *black jasper* and *basanite*. It was called *Lydian stone*, or *lapis Lydia*, by the ancients, because found in Lydia in Asia Minor.

A series of metallic needles (called *touch-needles*) of which the composition is known are used for comparison with the article to be tested, which is commonly gold or a gold alloy. When the colour of the streak produced by both the needle and the trinket on the stone is the same, the quantity of alloy they contain is supposed to be similar.

TOUCHWOOD. A soft white substance into which wood is converted by the action of such fungi as *Polyporus igniarius*. It is easily ignited, and continues to burn for a long time like tinder.

TOUL (töl). A town of France, in the department of Meurthe-et-Moselle, on the Moselle; served by the Eastern Railway. It is fortified, and has a Gothic church (St. Étienne), a former cathedral, dating from the thirteenth century. Toul was taken in the Franco-German War (23rd Sept., 1870) after a siege of five weeks, but was restored to the French, who again fortified it. Pop. 12,000.

TOULON-SUR-MER (ancient (Gr.) *Telonion*, (Lat.) *Telo Martius*). A seaport and first-class fortress, after Brest, the chief naval station of France, in the department of Var, situated on Toulon Bay, an arm of the Mediterranean; on the Mediterranean (Marseilles - Nice) Railway. Toulon has a former cathedral (Ste Marie Majeure), large naval dockyards, basins and arsenal, provided with bomb-proof moles and protected by forts. Trade is negligible, but there are shipping businesses. As *Telonion* and *Telo Martius*, Toulon was famous for dyes.

The town suffered severely at the hands of the Republicans in 1793 after the withdrawal of the British, whom the inhabitants had voluntarily admitted, and who destroyed the French Republican fleet. There is a broadcasting station (385 m., 8 kw.). Pop. (1931), 133,263.

TOULOUSE (tö-löz; ancient **Tolosa**). A city of Southern France, capital of the department of Haute-Garonne, on the Garonne and the Canal du Midi; an important junction of the Southern and Orleans Railways. The Pont Neuf spans the river. Toulouse is an educational centre, and is the entrepôt of the district for agricultural produce and general trade, as well as an important industrial centre. It has two wireless stations (385 m., 8 kw. and 255 m., 0·7 kw.). The ancient *Tolosa Volcarum*, Toulouse is a place

of great antiquity, and rose to eminence under the Romans.

It was the capital of the Visigothic kingdom (419-508), passed to Clovis, and subsequently became the capital of Aquitaine. It was long governed by independent counts, before falling to the French Crown and becoming capital of Languedoc. The French were defeated by the British under its walls in 1814. Pop. (1931), 194,564.

TOURAC'O. A name of birds of the genus Corythaix or Turăcus, natives of Africa, belonging to the cuckoo order (Cuculiformes), and family Musophagidæ. Their prevailing colour is green, varied in some species with purple on the wings and tail. They feed chiefly on soft fruits.

TOURAINE (tō-rān). A pre-Revolutionary province of France, which now forms the departments of Indre-et-Loire (mainly) and Vienne. Tours was the capital. United with Anjou in 1045, it passed to England (the Plantagenets) in 1154, but was re-acquired by France (Philip II.) in 1204. It was made a duchy in 1356, and united with the Crown in 1584.

TOURCOING (tör-kwaŋ). A town of France, in the department of Nord, contiguous with Roubaix; a junction on the Northern Railway. It is industrial, the staple manufactures being woollen, cotton, linen, and silk stuffs, and there are dye-works, soap-works, sugar-refineries, machine-works, etc. Pop. (1931), 81,972.

TOURGUENIEV, or **TURGENIEV, Ivan Sergeyevitsh.** Russian novelist, born in 1818, died near Paris in 1883. The descendant of a noble family, he was educated at Moscow, St. Petersburg (Leningrad), and Berlin, and in 1842 obtained an appointment in the Ministry of the Interior. For some years he led the life of a country gentleman, gaining an intimate acquaintance with Russian peasant life. In 1852, having written an article displeasing to the authorities (*Letter on Gogol*), he was imprisoned for a short time, then banished to his paternal estate for two years.

The latter part of his life he resided either at Baden-Baden or in Paris. His first important publication was *The Experiences of a Sportsman*, which was followed by a great number of short tales and dramas, contributed chiefly to Russian periodicals. His earliest novel, *Dimtri Rudin*, appeared in 1855, and was followed by *Helene*, *A Nest of Nobles* (*Lisa*), *Fathers and Sons*, *Smoke*, *An Unfortunate*, *Spring Floods*, *Virgin Soil*, etc. Tourgueniev has rightly been ranked with the greatest masters of fiction.

He was an artist, possessed of a great power of analysis and psychological insight, and was able to handle the most difficult subjects with a light and delicate touch. His chief characteristics were "tenderness and grace, and a certain mistiness of colour."—Cf. W. L. Phelps, *Essays on Russian Novelists*.

TOURMALINE (tör'ma-lin). A mineral occurring crystallised in the trigonal system as three-sided or six-sided prisms, terminated by three-sided pyramids. The crystals are differently terminated at opposite ends of the prismatic axis, and the ends show opposite kinds of electricity when heated. Tourmaline scratches glass easily, has a specific gravity of 3, and is a borosilicate of aluminium with sodium, and commonly iron, magnesium, and water.

Tourmaline occurs most commonly in igneous and metamorphic rocks, especially in granite, gneiss, and mica-schist. It is transparent, translucent, or opaque; colourless, green, brown, pink, or blue, but commonly black. Pink tourmaline is known as *rubellite*, blue as *indicolite*, and black as *schorl*. The transparent varieties include various well-known jewellery stones, as the Brazilian sapphire, the Brazilian emerald, etc. Tourmaline was once much used in polarising apparatus, since a section parallel to the principal axis, and not too thin, transmits rays vibrating in one direction only.

TOURNAI (tor-nā; in Flem. *Doornik*, dōr'nik; Rom. *Civitas Nerviorum* or *Turnacum*). A town of Belgium, in the province of Hainault, on the Scheldt; an important railway junction for Ghent, Brussels, Valenciennes, etc. Manufactures include linens, woollens, cottons, and Brussels carpets. Tournai is one of the oldest towns of Belgium, and was anciently the chief town of the Nervii, and afterwards the residence of some of the early Frankish kings. Captured by the Germans during the European War (23rd Aug., 1914), it was retaken by the British on 8th Nov., 1918. Pop. (1931), 35,940.

TOURNAMENT. The tournament or tourney was a form of recreation or sport among the nobility of European countries in the Middle Ages. It was a mock fight of knights on horseback, and the name is supposed to be derived from the necessity of a combatant's turning his horse rapidly. The fight was purely a display of skill and a method of preparation for war, and the combatants were

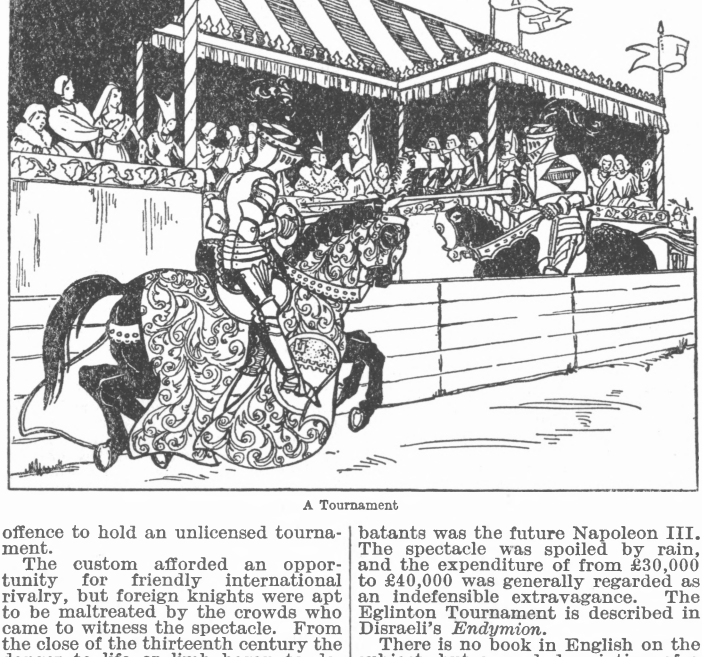
understood to bear no hostility, personal or national, towards each other.

Tournaments originated in the eleventh century in France, and rapidly acquired great popularity in England. They were disliked by the Crown, both because an assemblage of men in arms might be utilised as the beginning of a rebellion, and because of the risk to life and limb. Henry II. forbade them, and, though Richard I. withdrew the prohibition, a royal licence had to be obtained, and Edward I. made it a capital offence to hold an unlicensed tournament.

The custom afforded an opportunity for friendly international rivalry, but foreign knights were apt to be maltreated by the crowds who came to witness the spectacle. From the close of the thirteenth century the danger to life or limb began to decrease, and one objection to the amusement was removed. The use of pointed swords and daggers was forbidden, sham weapons were sometimes employed, armour was specially designed to be worn by knights in the tourney, and a barrier of wood between the combatants gave additional protection.

Accidents occasionally happened—the most famous is the death of Henry II. of France in 1559 from a wound in the temple caused by the splintered lance of his opponent—but the tournament tended to become a mere display or pageant, especially in France, though in England the older conception survived to the seventeenth century.

In 1839 a famous revival of the tournament was organised by the thirteenth Earl of Eglinton, who held at Eglinton Castle a tournament in which knights fought as of old with spears. One of the combatants was the future Napoleon III. The spectacle was spoiled by rain, and the expenditure of from £30,000 to £40,000 was generally regarded as an indefensible extravagance. The Eglinton Tournament is described in Disraeli's *Endymion*.



A Tournament

There is no book in English on the subject, but a good description of a tournament at Stirling in 1448 will be found in Hume Brown's *Early Travellers in Scotland*, pp. 30-38.

TOURNEUR, Cyril. English dramatist, born about 1575, died in 1626. Almost nothing is known of his life, except that he served in the Low Countries in 1613, and that he accompanied Sir Edward Cecil to Cadiz in 1625. On his return from

the expedition he took ill; he was put ashore at Kinsale, where he died, leaving his widow destitute. Tourneur's poems consist of *The Transformed Metamorphosis* (1600), a satire whose key is lost and which is written in an unintelligible jargon; and two elegies, *A Funeral Poem* on Sir Francis Vere and *A Griefe on the Death of Prince Henrie*, neither of which rises above the level of official lamentations.

Tourneur's fame rests entirely on his two tragedies, *The Revenger's Tragedy* (published 1607) and *The Atheist's Tragedy* (published 1611). It is almost certain that the play which was published the later was written the earlier of the two. *The Atheist's Tragedy* is immature, *The Revenger's Tragedy* a much stronger and more finished play. As dramas both plays leave much to be desired. They have little dramatic power, and their characters are caricatures. It is the force and flow of Tourneur's poetry that distinguishes his work.

In gloom and in tragic cynicism these plays resemble those of Webster; it has been said that Tourneur is to Webster as Webster is to Shakespeare. Swinburne in his characteristic eulogy has undoubtedly overvalued Tourneur, but on the strength of his masterpiece he must be placed among the great Jacobeans.—Cf. A. C. Swinburne, *The Age of Shakespeare*.

TOURS (tŏr; Rom. *Cæsarodunum*). A town of France, capital of the department of Indre-et-Loire, on the Loire; an important junction on the Orleans Railway. The Loire is crossed by suspension railway bridge and stone bridges, and there are several historic châteaux in the neighbourhood.

Tours is an archbishopric, and there is a cathedral (St. Gatien), flanked by two towers, 205 feet high, a fine building begun in the twelfth and completed in the sixteenth century. Of the twelfth- to thirteenth-century church of St. Martin of Tours only two towers remain.

Manufactures include silk, cloth, carpets, and chemicals, and there is some printing, etc. Tours early became famous for its silk manufactures, and had a population of 80,000, when the revocation of the Edict of Nantes deprived it of nearly half its inhabitants, a blow from which it has never recovered. In 1870 Tours was the seat of the Government of National Defence. The town surrendered to the Germans on 21st Dec., 1870, and was occupied on 20th Jan., 1871. Pop. (1931), 78,585.

TOURVILLE, De, Anne Hilarion de Cotentin, Comte. French admiral, born 1642, died 1701. He entered the navy in 1660, became captain in 1667, and vice-admiral in 1689. He defeated a Dutch and English fleet off Beachy Head in July, 1690, but in 1692 he was ordered to attack a far superior Dutch-English fleet off La Hogue, and was defeated. He was created marshal in 1693, and in 1694 destroyed a Dutch and English trading fleet off Cape St. Vincent.

TOUSSAINT L'OUVERTURE (tō-săn-lō-ver-tür). A West Indian negro leader, born a slave in the Island of Haiti in 1743, died in 1803. After the insurrection of 1791 Toussaint served in the army of the blacks, and subsequently became their leader. He displayed great military and political ability, and in 1796 the French Government appointed him general in chief of the troops in Santo Domingo. After a severe struggle with insurrectionary movements he assumed supreme civil authority, and in 1801 was completely master of the island.

He was appointed President for life of the Republic of Haiti, and under his vigorous government the commerce and agriculture of the island began to revive. But Napoleon did not choose to see him independent, although professedly loyal to France, and sent a powerful expedition to subdue Toussaint, who, after a vigorous resistance, was forced to surrender. He was sent to France, where he died in prison. There is a sonnet by Wordsworth entitled *To Toussaint L'Ouverture*.

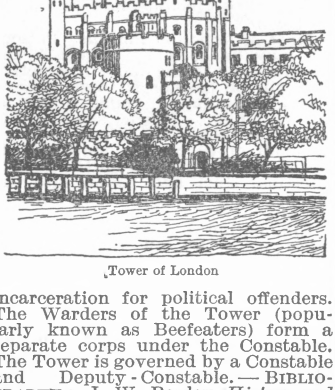
TOWCESTER. Town of Northamptonshire. It is 59¼ miles from London by the L.M.S. Railway, and 9 from Northampton. It has an agricultural trade, and brewing is carried on. The parish church has several features of interest, and there is a town hall and a corn exchange. Pop. 2383.

TOWER OF LONDON. An ancient fortress in London, consisting of a collection of buildings of various ages on a somewhat elevated position on the north bank of the Thames, outside the boundary of the old city walls. It covers about 13 acres, and is surrounded by a battlemented wall flanked with massive towers, and encircled by a moat. There is also an inner line of circumvallation broken by towers, and interspersed with other buildings. In the centre is the White Tower, the keep of the old fortress, around which are grouped the chapel, the jewel-house, barracks, and other buildings.

The Tower was a first-class mediæval fortress, and served at once as a palace, a prison, and a place of defence. The White Tower was built

by Gundulf, Bishop of Rochester, for William I. in 1078. It was successively strengthened by various English sovereigns. The regalia, consisting of the royal crowns, sceptres, etc., are kept and exhibited in the jewel-house. The armoury contains a fine collection of armour and weapons.

In the part called the Bloody Tower the two young princes, sons of Edward IV., were murdered. The Tower is now chiefly used as an arsenal, and has a small military garrison, which was considerably increased during the European War, when the Tower became a place of



Tower of London

incarceration for political offenders. The Warders of the Tower (popularly known as Beefeaters) form a separate corps under the Constable. The Tower is governed by a Constable and Deputy-Constable. — BIBLIOGRAPHY: J. W. Bayley, *History and Antiquities of the Tower of London*; Lord Ronald Gower, *The Tower of London*; R. Davey, *The Tower of London*.

TOWN COUNCIL. The governing body of a borough or city. The council is elected by the ratepayers, and usually comprises three members for each ward of the borough or city. These hold office for three years. They elect their own chairman, who is known in England as the Mayor or Lord Mayor, and in Scotland as the Provost or Lord Provost. He is the chief civil functionary and municipal magistrate, and is ex officio a justice of the peace. The councillors also elect about one-fourth of their number (in the metropolitan boroughs one-seventh) as aldermen or, in Scotland, bailies, who rank next to the Mayor or Provost and are also magistrates.

The council has charge of the local affairs of the borough or city, e.g. public health, police, roads, lighting, housing, etc., and has power to levy rates. It has a clerk, usually a solicitor, who holds office at its pleasure, and cannot be a member of it. He has charge of the records and attends to the business of the council. A councillor holds a fiduciary position, and cannot contract with the council of which he is a member.

TOWN PLANNING. Phrase used for laying out an area in order to give it a pleasing appearance and ensure healthy conditions. Something of this kind was done in the nineteenth century when new towns were planned, especially in the United States, and where land was plentiful. In 1909 in England a law was passed to encourage town planning, and other Acts followed. The law was consolidated in 1925, and in 1932 a further measure was passed.

The effect of these laws is to give local authorities power to make plans for any area that is built over. They can restrict the number of houses per acre, provide open spaces, and make other regulations that will prevent the district from becoming a slum area. They can improve areas in which housing conditions are bad, make roads, and build houses.

TOWNSHEND, Charles, second Viscount. English statesman, born 1674, died 1738. He succeeded to the peerage in Dec., 1687, and took his seat as a Whig in the House of Peers in 1695. After acting as a commissioner for arranging the Scottish Union (1706), he was joint plenipotentiary with Marlborough in the conference at Gertruydenburg (1709), and then, as Ambassador to the States-General, signed the Barrier Treaty. For this he was censured by the House of Commons, and declared an enemy to the queen and kingdom.

He thereupon entered into communication with the Elector of Hanover, who, on his accession as George I., appointed Townshend Secretary of State (1714). In 1717 he became Lord-Lieutenant of Ireland; and he was again Secretary of State from Feb., 1721, to May, 1730, when he retired on account of differences with his brother-in-law and colleague, Sir Robert Walpole.

TOWNSHEND, Charles. Grandson of the above, born 1725, died 1767. He entered the House of Commons in 1747, and became a Commissioner of Trade and Plantations in 1749. He was a Lord of the Admiralty in 1754, member of the Privy Council in 1756, Secretary of War from 1761 to 1763, and Chancellor of the Exchequer in 1766. He supported Gran-

ville's Stamp Act (1765), and introduced the celebrated resolutions for taxing the American colonies (2nd June, 1767). From so often changing his political opinions he was known as the "weathercock," but he had a great reputation for oratory and wit.

TOWNSHEND, Sir Charles Vere Ferrers. British soldier, born 1861, died 1924. He entered the Royal Marines in 1881, but transferred to the army, commanding the garrison of Chitral Fort during the siege (1895), for which he received the thanks of the Indian Government, and taking part in the Nile Expedition (1898) and the South African War (1898-1900). In 1909 be became brigadier-general, and in 1911 major-general.

During the European War he was posted to the 6th (Indian) Division in Mesopotamia, and assumed command in April, 1915, almost immediately defeating the Turks at Kurna and Kut-al-Amarna. He was ordered to push on to Bagdad, and, in his march up the Tigris, he again defeated the Turks at Ctesiphon; but the weakness of his force compelled his retirement upon Kut, where his force was beleaguered for 143 days, and eventually capitulated owing to starvation and disease.

General Townshend himself remained a prisoner in Prinkipo Island until Oct., 1918. In Nov., 1920, he became Independent member of Parliament for The Wrekin, and joined the Conservatives during 1922. He received the K.C.B. (1916), and resigned from the army in 1920. He died on 18th May, 1924. *See* EUROPEAN WAR (*Mesopotamian Campaigns*).—Cf. his book *My Campaign in Mesopotamia*.

TOWNSVILLE. A seaport of North Queensland, Australia, on Cleveland Bay, a terminal of the North Queensland Railway. As the port of an immense territory, including a large area of pastoral country, there is a large shipping trade. Pop. (1931), 32,050.

TOWTON. A village of England, in Yorkshire, 3 miles south-east of Tadcaster. Towton is noted as the scene of a battle between the Yorkist forces and the Lancastrians in 1461. Pop. 78.

TOWYN. A watering-place of Merionethshire, Wales, situated on Cardigan Bay. It is 11 miles from Tainbourne and 223 from London, on the G.W. Railway. Pop. (1931), 3803.

TOXICOLOGY. The science which deals with the effects of doses of drugs large enough to endanger life, and a subdivision of the science of *pharmacology*, which treats of the actions of drugs on the body both in health and disease. In practice, however, this definition is too narrow, and must be extended to cover all substances which endanger human life, as drugs, chemicals, irrespirable gases, foods, and vegetable and animal products.

Toxicology has been pithily described as the science of poisons, and this is perhaps as good a definition as any. A poison has been defined as "any agent capable of producing a morbid or dangerous effect upon anything endowed with life;" in the narrower medico-legal sense "a poison is a substance which, if applied to the body or administered internally, has been applied or administered with the *intention* to kill or do harm."

Mode of Action of Poisons. Poisoning may be *acute* or *chronic*. The chronic type is the more instructive and will be considered first, *chronic arsenical poisoning* being taken as an example. When arsenic, i.e. arsenious anhydride, is administered in small doses by the mouth, it is absorbed in solution from the gastro-intestinal tract and passes into the blood, which carries it to all parts of the body.

Elimination begins at once, and takes place by all the excretory channels, viz. by the urine, fæces, sweat, tears, saliva, etc. As elimination is slow, there is a tendency for the substance to accumulate in the tissues of the body—a fact of great medico-legal interest, as the bodies of those who have died from chronic arsenical poisoning preserve their life-like appearance for a long time, owing to the preservative property of the arsenic taken.

Arsenic having decided toxic properties, it is obvious that it will exert them more or less in all the tissues of the body; thus it is excreted by the gastric and intestinal mucous membranes, and great hyperæmia is induced, which is an irritant effect. As a result there is nausea, pain in the epigastric region, sickness and vomiting, and diarrhœa alternating with constipation; the nutrition of the body is impaired, with consequent loss of weight; in the same way there is a catarrhal condition of the mucous membranes of eyes, nose, and mouth.

The skin also is affected, for the natural pigmentation is remarkably increased, the lower part of the abdomen, for example, becoming yellowish-brown; while there is irregular growth of the nails and falling out of the hair. The nervous system is also

involved, a peripheral neuritis being indicated by loss of sensation in the hands and feet and loss of power of movement, shown at one stage by wrist- and foot-drop.

Post-mortem examination of the principal organs, i.e. stomach, liver, kidneys, heart, etc., shows widespread fatty degeneration, while chemical analysis reveals arsenic in greater or less quantity in all the organs most affected. The fatal result following prolonged administration of overdoses of arsenic is due to widespread pathological changes and not to a localised effect.

The form in which the arsenic is administered is of little importance provided it is absorbed; even the gaseous diethylarsine evolved from damp arsenical wall-paper under the influence of fungi produces a chain of symptoms similar to those described.

Chronic poisoning by salts or preparations of lead, mercury, copper, antimony, tin, or zinc, or by phosphorus, ergot, morphine, cocaine, etc., is well known; and as each of these substances produces its own peculiar set of symptoms, it is possible for the physician to make a shrewd guess as to the nature of the poisonous material from the symptoms of the patient and, in certain cases, from the nature of his employment.

In certain vocations the workers are medically examined at definite intervals, and when a case of industrial poisoning is found, notification is compulsory under the Factory and Workshop Act, 1895; in addition, processes are modified to eliminate industrial poisoning, as in the production of leadless glazes, and matches with red instead of yellow phosphorus.

Acute poisoning follows the administration of large doses of poisonous substances, and is frequently the event in chronic poisoning which leads to the detection of the latter. The effect is usually (1) local and (2) remote. The local effect may be that of a corrosive or an irritant.

The corrosive effect is seen in the widespread destruction of the tissues which results when sulphuric acid is applied to the skin or to a mucous membrane, as in the act of swallowing; the symptoms come on at once after swallowing, and consist of burning, agonising pain in the mouth, throat, gullet, and stomach, with continuous retching and vomiting of shreddy bloodstained material; intense thirst is present, and often the air-passages are involved. The mind is clear; death may occur early, and be due to "shock," or the destruction of the tissues may result in suffocation from involvement of the larynx, or in death from perforation of the stomach.

Recovery may take place after such a "burn," the necrotic tissue being thrown off and replaced by cicatricial tissue; this contracts, obliterating more or less the lumen of the œsophagus and stomach, so that death frequently follows weeks or months later from starvation.

The local irritant effects ensue at a variable time after a poison has been swallowed, usually from a half to one hour later. The gastro-intestinal tract is inflamed, the inflammation passing to ulceration, and giving rise to severe pains in the abdomen, with violent continuous vomiting and diarrhœa. Thirst is very intense, and drinking does not quench it but induces more vomiting.

Death may be due to shock or collapse; the pulse becomes thready and irregular, and the skin clammy and cold; cramps may occur in the muscles of limbs; the mind, which has been clear, becomes clouded, and unconsciousness with or without convulsions ushers in the end. The fatal termination may be delayed, and is then usually due to the "remote" action of the poison taken or to the *sequelæ* of inflammation of the gastro-intestinal tract.

The remote action of a poison occurs after absorption from the stomach and intestines, and this applies whether there has been any local action or not. The narcotics, for example, may cause little or no local reaction in the gastro-intestinal tract, and are all the more dangerous on that account. Once in the bloodstream, the poison may act in many ways.

Chloroform, chloral hydrate, morphine, alcohol, etc. (the narcotics), depress the whole functions of the brain and spinal cord, and when the centres in the *medulla oblongata*, which control the muscles of respiration and the heart itself, are depressed sufficiently, death ensues. Hydrocyanic (prussic) acid attacks these centres very quickly, causing almost instant death. Strychnine acts on the motor cells of the anterior cornua of the spinal cord, making them so sensitive to incoming or afferent stimuli that the whole musculature of the body passes into a sustained spasm, so that respiratory and cardiac movements are impossible, and death ensues.

Substances such as potassium chlorate, nitrites, and carbon monoxide attack the blood itself, the former converting the hæmoglobin of the blood into met-hæmoglobin, while the other two form addition products, the net result in each case

being that the normal oxygenation of the blood fails and death follows. Other substances, such as digitalis, act on the heart.

Treatment of a Case of Poisoning. From the foregoing it is evident that the treatment of a case of poisoning is essentially twofold: (1) local, to prevent or limit absorption; and (2) general, to combat the effects after absorption.

Local Treatment. This consists in removing the noxious material as far as possible by encouraging vomiting or by washing out the stomach, while at the same time administering an antidote to neutralise the poison, or to convert it into an insoluble compound which can no longer be absorbed and may be removed by lavage. Vomiting may be induced by tickling the fauces with a feather or with the finger; it is better to give an emetic such as a solution of common salt, two tablespoonfuls dissolved in half a tumblerful of tepid water, or twenty grains of sulphate of zinc, or one-tenth of a grain of apomorphine hydrochloride hypodermically.

If these fail, an improvised siphon tube can be made with about 5 feet of strong rubber tubing about half an inch in diameter, and marked 20 inches from one end by a thread of worsted, while the other end carries a funnel of glass or metal; the lower end of the tube is placed in the mouth and pushed onwards until the back of the throat is reached, then the point is moved downwards by the finger placed above, and the tube pushed onwards until the worsted mark is in contact with the teeth.

The lower end of the tube is now in the stomach, and it is an easy matter to introduce 2 pints of warm water, containing the antidote selected, by raising the funnel bearing end of the tube above the patient's body and pouring the fluid into the funnel; by depressing the funnel to a point lower than the patient's stomach, taking care to pinch the rubber tube close to the funnel while it is yet full, and when it is in the lowest position releasing the pressure, the fluid introduced siphons off, carrying with it more or less of the deleterious material.

The process is repeated frequently until the fluid introduced returns unchanged. The stomach pump is essentially the same as the siphon tube, but has as an addition a bulb with valves to regulate the flow. This is the process known as "lavage." In those cases in which vomiting is well established, the patient is encouraged to drink water containing the antidote in the intervals between the attacks of vomiting. When it is obvious that no more foreign material is being removed, demulcent drinks of milk, egg-flip, or barley water may be given, and, after narcotic poisoning, stimulants such as tea, coffee, and weak spirits may be administered.

Antidotes. The use of an antidote presupposes that the nature of the poison is known, otherwise one must go on general principles, using emetics and lavage as the case may be. This is particularly true of poisoning due to organised substances such as laburnum pods, belladonna, yew berries, aconite root, or tainted foods, animal or vegetable; as well as to that due to narcotics like alcohol, chloroform, chloral hydrate, sulphonal, etc.

In many instances, however, the poison is known either by name or by its effects. The best antidote in cases of poisoning by corrosives generally, such as mineral and organic acids, with the exceptions of oxalic and carbolic acids and mercuric and zinc chlorides, is calcined magnesia (MgO) mixed with water to form a thin milk-like fluid; in the absence of this substance, sodium bicarbonate (baking soda) in the proportion of a tablespoonful to a tumblerful of warm water may be used freely, or calcium carbonate in the form of "whiting," chalk, or tooth powder may be used in the same manner as magnesia.

For oxalic acid and oxalates (salt of sorrel), calcium carbonate is the only antidote. Carbolic acid and its homologues and preparations, as cresol, lysol, creolin, etc., do not react like ordinary acids to alkalies, with the result that milk, and white of eggs switched with milk or water, are the most efficient antidotes, followed by lavage; later, one may give sodium or magnesium sulphate well diluted with water to promote elimination.

Soluble lead and barium salts have an efficient antidote in magnesium or sodium sulphate, while arsenic in solution is precipitated by a mixture of tincture of steel (perchloride of iron), water, and calcined magnesia. Strong alkalies, as caustic potash and soda, are neutralised by cream of tartar and lime juice, and this applies to a certain extent to ammonia solution, the most urgent symptoms of which are, however, respiratory rather than gastric.

Poisoning by opium and its derivatives morphine and laudanum is treated by lavage with water coloured pink with potassium permanganate, while phosphorus poisoning due to

matches or rat paste is treated in the same way or with very weak "Sanitas."

General Treatment. This is threefold, and consists of: (1) the use of physiological antidotes when these are possible, (2) the improvement of elimination from the body by all the natural channels, and (3) the treatment of "shock" and other dangerous and urgent symptoms as they arise.

The use of physiological antidotes is very limited; thus in opium (inclusive of morphine and laudanum) poisoning, the depression of the central nervous system may be combated by strong tea and coffee (i.e. caffeine); strychnine is overcome by choloroform anæsthesia or large doses of chloral hydrate, both of which depress the functions of the brain and, later, that of the cord; belladonna and atropine by morphine injections; the object in all cases being to prolong life that natural elimation processes may take effect.

Improvement of elimination is obtained by rectal lavage, subcutaneous saline injections, and the use of hot packs. Urgent symptoms, such as "shock," require the application of heat and the use of stimulants, and failure of breathing calls for artificial respiration to tide over, if possible, the critical period.

The action of a poison is modified by many circumstances. (1) *Quantity.* It is not legitimate to conclude that a large quantity of a poison is more likely to have a greater effect than a small quantity. It is true to a certain extent, but large allowances have to be made. The large quantity may induce severe vomiting and diarrhœa, and thus be expelled from the system, while the smaller quantity may be mostly absorbed; thus 10 grains of tartar emetic have killed a boy of five, while recovery has followed 60 grains. (2) *Chemical combination* is of great importance, for it is on the fact that certain compounds of a given poison are non-poisonous that the use of antidotes is based.

Potassium cyanide, a virulent poison, can be converted into harmless potassium ferrocyanide by mixing it with ferrous sulphate and an alkali; morphine is oxidised to a harmless derivative by potassium permanganate; and heavy metals, as lead, silver, and copper, can be changed into insoluble salts, as sulphate, chloride, or ferrocyanide, and so rendered harmless. (3) The *part of the body* to which the poison is applied has a great influence on the rapidity of its action. Inhalation of a poison, as a gas or vapour, allows its action to be most rapid, for absorption into the blood of the lungs takes place at once.

Intravenous injection acts with equal rapidity; subcutaneous injection, as of morphine, is somewhat slower in its effect; and following this we have absorption from mucous surfaces, as the gastro-intestinal tract, the nose and body passages, and lastly the broken and unbroken skin.

Certain substances have no poisonous effects when taken by the mouth, and only exhibit their characteristic action when injected subcutaneously, examples being snake venom and adrenalin. (4) *Habit.* Those accustomed to the use of a drug acquire a degree of tolerance or immunity. Striking examples of "habit" are seen in morphomaniacs, who often take 6 to 10 grains of morphine hydrochloride per day without experiencing any ill effects. (5) *Condition of health.* Debilitated individuals are more susceptible to the influence of poisons than healthy people.

There are many exceptions, e.g. diabetics can take much larger doses of morphine and alcohol than normal individuals, while in mania from any cause the amount of sedative substances, such as chloral hydrate and hyoscine, which can be borne without apparent effect is most surprising. (6) *Idiosyncrasy.* This is a peculiar intolerance which is shown by many individuals to very small doses of drugs which normally produce no ill effects; 2 grains of calomel have produced all the symptoms of mercurial poison, while 10 grains of sodium salicylate have produced a widely diffused pustular eruption.

The Chemistry of Poisons. As cases of poisoning in many respects resemble natural disease as regards onset and clinical signs, it becomes necessary to apply most vigorous physical, chemical, and physiological tests to the vomit, contents of the stomach, and to certain organs, as the stomach itself, liver, kidneys, etc. Inspection of the vomit or the stomach contents will reveal poisoning by cantharides (the green wing-cases of which are characteristic), croton and castor seeds, apricot kernals, and aconite root, while the sense of smell will cause the detection of phosphorus and cyanides—including hydrocyanic acid and seeds which yield this substance on maceration—laudanum, alcohol, carbolic acid, etc.

In most cases, however, the poison requires to be separated and identified by its physical appearance and

by chemical tests; this is a matter for analytical chemistry, and need not detain us here. Dealing with alkaloids such as morphine, strychnine, atropine, and cocaine, the quantity obtained by the analyst may be so small as to prevent its recognition by physical characteristics. Recourse must then be had to experiments on animals. Strychnine, for example, can be recognised by its action on frogs, and atropine by its action on the eye of a cat; these physiological and chemical tests combined are conclusive, though either group by itself may be most unsatisfactory.

The examination of tainted foods, both animal and vegetable, is chiefly bacteriological. Foods prepared by heat and preserved in hermetically sealed tins and jars are liable to ferment or undergo less obvious changes on storage. The sterilisation has been inefficient in such cases, the *spores* of many bacteria resisting the action of heat for a long time, although the free bacteria are all killed in the process. On storage, however, the spores develop, and if the bacteria are anaerovic, i.e. can live in the absence of air, the food in course of time is badly infected.

Various substances are produced by the action of these bacteria-gases, giving the so-called "blown" tins, and toxins or substances of an albuminoid nature, which may have a very poisonous effect on the human subject, causing severe gastro-intestinal disturbances, and at times death.

Two organisms are usually associated with tainted foods, viz. bacillus botulinus and bacillus enteritidis of Gaertner. The former is anaerobic, and produces a toxin of intense virulence acting on the central nervous system and causing dilatation of the pupils with loss of vision, diplopia, and general paralysis, ending in death ("botulismus"); the latter is found in foods exposed to the air, and its toxins cause severe vomiting and diarrhœa, with death from a form of septicæmia.

What is popularly called "ptomaine poisoning" is therefore bacterial poisoning, due to the growth of organisms in the food consumed, as sausages, ham, pork, corned beef, etc. Shell-fish poisoning is doubtless similar in origin, although the work of Brieger and others points to another conclusion. *See* BACTERIOLOGY; PRESERVED FOODS.

Poisoning by Irrespirable Gases. The hydrogen compounds of arsenic, antimony, and phosphorus are very poisonous, as their absorption into the blood from the lungs is exceedingly rapid. The same is true of sulphuretted hydrogen, carbon monoxide, and carbon dioxide, the two last being the cause of the commonest forms of gaseous poisoning.

The treatment in every case is transference of the patient to the fresh air, and thereafter the use of stimulants, hot packs to promote elimination, and artificial respiration when signs of failing respiration appear. The condition of the blood in two of these forms of poisoning has already been referred to. During the European War irrespirable gases were used on a very large scale.

At first they consisted of gases which had an irritant action on the tracheal and bronchial mucous membrane, causing acute bronchitis, emphysema, and pneumonia, which frequently had a fatal issue; at a later date the gases were often merely vapours which condensed to liquid upon the clothing and skin of the combatants, setting up forms of generalised irritation which often proved fatal. *See* POISONOUS PLANTS; POISON-GAS WARFARE.

BIBLIOGRAPHY: W. E. Dixon, *Manual of Pharmacology*; Professor Glaister, *Medical Jurisprudence and Toxicology*; Dixon Mann and William A. Brend, *Forensic Medicine and Toxicology*; E. W. Hope, *Industrial Hygiene and Medicine*; John D. Gimlette, *Malay Poisons and Charm Cures*.

TOYNBEE HALL. A London University settlement located at 28 Commercial Street, Whitechapel, E.1. It was opened in Dec., 1884, as a memorial to Arnold Toynbee (1852-83), the British economist, who was educated at Pembroke and Balliol Colleges, Oxford, and who devoted his life to the amelioration of the social condition of the poor, especially in the east end of London. The Hall is of the nature of a residence, where university men can follow in the footsteps of the founder.

TRACHEA (trā′kē-a), or **WINDPIPE.** In anatomy, the name given to the tube extending from the larynx (q.v.) down into the chest to a point opposite the third dorsal vertebra, where the tube divides into two chief divisions or bronchi (q.v.), one of which supplies each lung with the air necessary for respiration or breathing. The trachea in man is of cylindrical form, about 4½ inches long, and from ¾ to 1 inch in diameter, and is composed of from sixteen to twenty rings or zones of gristly or cartilaginous nature, separated and connected by fibrous tissue.

Each cartilage forms an imperfect ring, being unclosed behind, and

having the gristly edges merely joined by fibrous membrane. The windpipe is lined by delicate mucous membrane which is covered by epithelial cells provided with delicate vibratile processes or *cilia*. All mammals, reptilia, and birds possess a trachea, but some amphibia want this organ, the lungs in such cases springing directly from the larynx.

TRACHEOTOMY. A surgical operation to establish breathing through an opening in the wall of the trachea; called for when there is serious obstruction to respiration by way of the natural air-passage at a higher level. Diphtheria, certain forms of laryngeal inflammation and paralysis, œdema, and tumour in the larynx or pressing upon it from without are among the pathological conditions which cause such obstruction.

The operation is also performed in other circumstances, e.g. as a preliminary to operations which might otherwise involve the inhalation of blood or infected material. The surgical procedure adopted is known as *high* or *low* tracheotomy according to its site, either above or below the isthmus uniting the two halves of the rhyroid gland across the middle line of the neck. A *tracheotomy tube* is used to maintain the patency of the opening made into the lumen of the trachea.

TRACHYTE (trā′kīt). A compact volcanite rock, breaking with a rough surface, and containing some 65 per cent of silica. The term is now limited to rocks intermediate between rhyolite and andesite. Large crystals of clear orthoclase often occur, with soda-augite, hornblende, or biotite.

TRACKS, RAILWAY. The permanent way in general use on the railways of Great Britain is of the chaired type, consisting of steel bull-head rails supported by, and keyed into, cast-iron chairs secured to wood sleepers. The gauge, or distance between the inside edges of the rails, is 4 feet 8½ inches, this distance usually being very slightly increased on sharp curves.

The rails vary in weight from 80 lb. to 100 lb. per yard, depending upon the nature and density of the traffic. The length of the rails also varies from 30 feet to 60 feet, but the latter length is exceptional, 45 feet rails being most commonly used. The weight of the cast-iron chairs ranges from a minimum of 38 lb. to a maximum of 56 lb. On some railways it is the practice to use a heavier chair in conjunction with a larger sleeper, on either side of each rail joint, for the purpose of giving it additional support. The keys or wedges used for securing the rail in the jaws of the cast-iron chairs are usually cut from oak or teak. Keys made of steel are also in use to a limited extent, and are of value in preventing "creep," or forward movement of the rails under traffic. The rails are connected at each joint by means of two rolled-steel fishplates and four fishbolts.

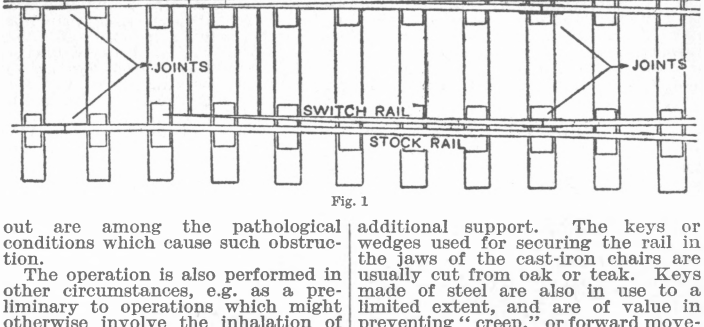


Fig. 1

Various methods of fastening the cast-iron chairs down to the sleepers are in use, such as bolts passing right through the sleeper, with the nut either on the under side or top; heavy coachscrews; or wrought-iron spikes used in conjunction with oak trenails, two spikes and two trenails being used to secure each chair. The ordinary sleepers are 8 feet 6 inches or 9 feet long, 10 inches wide, and 5 inches deep, and are usually cut from Baltic redwood.

Before being laid in the track they are impregnated with creosote oil, the general practice being to force about 2¼ gallons into each sleeper under pressure. The spacing of the sleepers in every rail-length varies, the normal distance apart decreasing

near the joint, where the rail is weakest.

Switches and Crossings. The general design of the switches and crossings does not vary to any appreciable extent, the differences being in such details as the planing of the switch rails, and in the design of the heavier chairs which are used for this class of work. The switches in use may be classified generally under two heads, "heel" switches and "heelless" switches. In the former, the heel of the planed or tapered movable switch rail is connected to the turnout rail by means of two fishplates, this movable switch rail being more or less free to pivot about the joint (fig. 1).

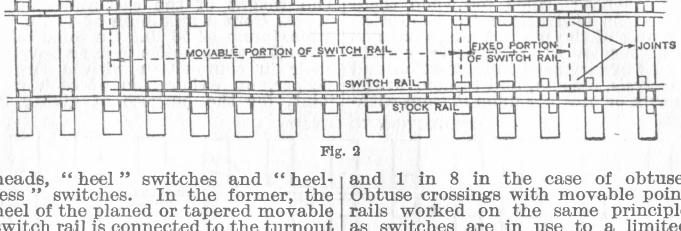


Fig. 2

In the heelless type of switch a longer rail is used in the manufacture of the movable switch rail, but it is rigidly fixed by means of suitable chairs from a point approximating to the joint at the end of a heel switch (fig. 2). The "spring" of the switch rail is sufficient to allow the tapered end to move freely without risk of fracture. The advantages of heelless switches are increased support to the switch rail and improved running due to the continuity of the rail. The tendency of modern practice is to favour the use of heelless switches exclusively.

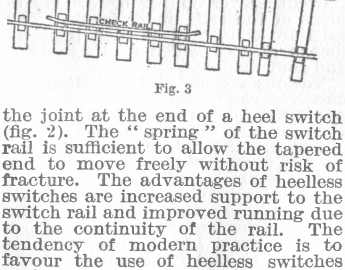


Fig. 3

In each pair of switches, the two switch rails are connected across the four-foot by means of stretcher rods, the length of which is regulated so that when the tapered portion of one switch rail is against the stock rail, there is a space of about 4 inches between the opposite switch and stock rail, to allow the wheel flanges to pass. This dimension of 4 inches constitutes the "travel" of the point of the switch rails when moved over from one position to another. Crossings in general use are of two kinds, common or "V" crossings (fig. 3) and obtuse or "K" crossings (fig. 4).

The flattest crossings in ordinary use are 1 in 16 in the case of common, and 1 in 8 in the case of obtuse. Obtuse crossings with movable point rails worked on the same principle as switches are in use to a limited extent (fig. 5). This type of obtuse crossing eliminates the danger of wheel flanges striking the end of the point rails and causing derailment, and also gives smoother running owing to the continuous rail surface.

A further, and perhaps greater, advantage is that it can be made flatter than the ordinary obtuse crossings, and is therefore of the greatest use in fast-running junctions where it is necessary to get the maximum radius of curve. Common crossings having a movable wing rail which is held in its normal position by a spring are also used to a limited extent, the object of this design (fig. 6) being to provide a continuous surface for the wheels when travelling along the main line, in order to minimise shock. These are known as spring crossings.

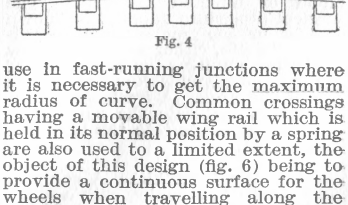


Fig. 4

The essentials for a good permanent way are a solid foundation and efficient drainage, good ballast, sound design of component parts of the track, and efficient maintenance.

Before the permanent way is laid down, the ground is carefully levelled or graded to a fixed distance below the level at which the rails are to

stand, the surface being cambered to allow the water percolating through the ballast to find its way quickly into the side drains. After this is completed, a layer of bottom ballast of rough stone or other suitable material is laid down, and on top of this a thinner layer of finer ballast, such as gravel, broken stone, slag, or cinders, is placed to form a medium for the final adjustment of rail level, and also to ensure an even bed for the sleepers (fig. 7).

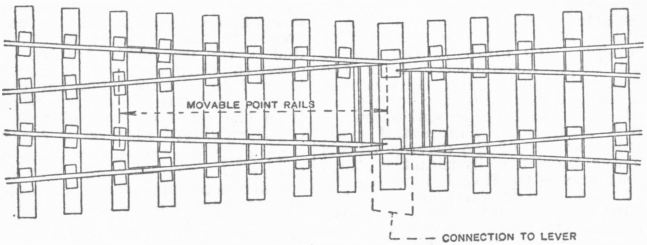


Fig. 5

Where the permanent way is curved, vehicles travelling along it exert a side pressure on the outside rail, and in order to counteract this the track is canted or "super-elevated" where possible, the amount of this super-elevation, the maximum of which is about 7 inches, being determined usually by the maximum speed at which trains pass round the curve.

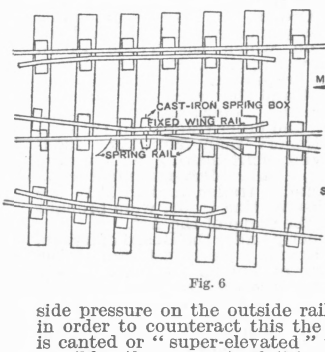


Fig. 6

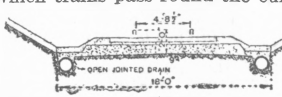


Fig. 7

TRACTARIANISM. *See* OXFORD MOVEMENT.

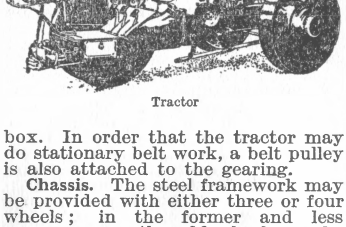
TRACTORS. A term originally applied to mechanically propelled vehicles used for haulage purposes, but now generally restricted to vehicles driven by internal-combustion engines. The application of the tractor to agricultural operations began in the latter part of the nineteenth century, when heavy traction steam-engines were used for ploughing and cultivating. Experiments to replace the steam-engine by a lighter and more mobile internal-combustion engine, suitable for moving with the implements, resulted in the evolution of the modern tractor.

During the European War, specially rapid strides were made in improving it, so much so that the outfit of the large up-to-date farm is incomplete without it. The tractor essentially consists of an internal-combustion engine set on a metal wheel-bearing frame, or *chassis*, which the former propels through the agency of a device for transmission of power, the speed and direction of motion both being controllable. The *engine* works on the Otto cycle, and may have one, two, or four cylinders, arranged in the last-named type either in a lengthwise direction behind each other or in a crosswise direction with respect to the longest axis of the machine.

Two or four cylinders give a more even torque and therefore less vibration. The necessary ignition to explode the gaseous charge in the cylinders is provided by a high-tension magneto, driven from the engine shaft by a chain or spur gear. Either petrol or paraffin can be used as fuel, but most types are suited to starting on petrol and working on paraffin by means of a modified carburettor, a device for vaporising the fuel.

Engine-cooling is effected by the pump radiator circulation method, in which water is circulated by pumping from a radiator through a series of pipes or by the thermo-siphon principle, aided by a rapidly revolving fan, as in certain types of motor-cars. Lubrication is best carried out on the forced-feed principle.

Transmission gear is necessary to transfer the power liberated at the engine to the driving wheels, and as it must be so constructed as to reduce the speed from the 300 to 1000 revolutions per minute of the engine to a wheel speed of roughly 3 to 4 miles per hour, it takes the form of a system of spurred gearing. A gear box is provided for varying the speed or for reversing. To allow of the engine shaft being disconnected from the transmission gear so that the mechanism may be started or the engine run while the machine is stationary, a clutch is fitted. Differential gear, permitting one of the driving wheels to travel more rapidly than the other, as happens in turning, is fitted to the back axle. The drive is communicated to this axle in most cases; in three-wheeled machines, however, each wheel is driven direct from the gear box. In order that the tractor may do stationary belt work, a belt pulley is also attached to the gearing.



Tractor

Chassis. The steel framework may be provided with either three or four wheels; in the former and less common case, the odd wheel may be either behind or in front. Propelling wheels vary from 3 to 5 feet in diameter by 10 to 12 inches in width, while front wheels measure from 2½ to 3 feet in diameter by 6 inches in width. They are provided with detachable projections, called "spuds," for use while working on the land. In some instances caterpillar wheels (similar to "tank" wheels) are provided. The steering device usually takes the form of a worm gear.

The power of tractors varies between 10 and 30 b.h.p., the weight from 17 to 50 cwt., and the length from 8 to 12 feet. The speed can usually be varied from 1½ miles per hour to about 5 miles per hour. The tractor is a most adaptable unit in farm machinery. It can be used for hauling tillage implements and harvesting machines, for road haulage work, and for such stationary work as threshing, sowing, and chaff-cutting. Its greater power allows of its drawing larger implements than ordinary farm horse teams, so that more work may be carried through in a limited time.

As success in farming largely depends upon making the best possible use of favourable weather conditions, the tractor proves invaluable to the farmer in sowing an increased acreage under ideal conditions and harvesting it again as desired. The actual increase in the value of the produce due to the use of the tractor is not easy to estimate, but it must be taken into account when the tractor is compared with other forms of power from the point of view of economy. Cf. *Agricultural Machinery Review*.

TRADE BOARDS. Boards, consisting of an equal number of representatives of employers and employed and of a small number of nominated members, established by the Trade Boards Act, 1909, their duties being to consider industrial conditions and to fix minimum rates of wages in certain industries, and to vary or cancel these rates from time to time.

The industries covered by the original Act were tailoring, paper box-making (cardboard and the like), machine-made lace-finishing, and chain-making; but it was extended to other trades by means of Provisional Orders. In 1918 an amending Act was passed which broadened the basis on which the Trade Board system was applied. Forty-five Trade Boards are now in operation, including boot and shoe repairing, stamped and pressed metals, fur, milk distribution, and other trades. In 1913 the confectionery-manufacturing, food-preserving, shirt-making, hollow-ware making, embroidery-manufacturing, and laundry trades, and in 1919 the milk-distributing trade, were brought within the scope of the Act.

Formerly under the Board of Trade, these Boards were transferred to the Ministry of Labour in 1917. Their primary purpose is the establishment of minimum rates of wages, both time-rates and piece-rates, but Boards also normally declare the standard of working hours and fix overtime rates; they have no power, however, to limit the number of working hours. Employers must pay at least the minimum rates clear of all deductions, under a penalty not exceeding £20 for each offence and £5 for each day on which the offence is continued after conviction. No agreement in contravention of the Act is valid. Official copies of Trade Board orders have to be displayed where the workers concerned can see them.

TRADE DISPUTES ACTS. The Trade Disputes Act, 1906, and the Trade Disputes and Trade Unions Act, 1927, define the legal position of

trade unions, in respect of disputes between them and employers. The legal position of the unions generally is defined in a whole series of Acts dating back to 1824. The 1906 Act clarified and amplified the law relating to trade disputes, thrown into confusion by the Taff Vale judgment of 1901 by which a union was held to be liable for the tortious acts of its officials, could be sued in its registered name, and its funds made liable for damages. To restore the unions to the position they supposed themselves to occupy prior to the Taff Vale judgment, the 1906 Act provided that no court should entertain an action against a union or its members, or officials acting on its behalf in respect not only of wrongful actions committed in pursuance of a trade dispute, but tortious acts in general; the Act also made it clear that no action done in contemplation or furtherance of a trade dispute should be actionable although it interfered with the trade, business, or employment of another person. The 1906 Act further safeguarded the unions' position in regard to "peaceful picketing," by providing that it should be lawful for one or more persons, acting for themselves or for the union to attend at or near a house or place where a person resides or carries on business or works, for the purpose merely of "peacefully obtaining or communicating information or peacefully persuading any person to work or abstain from working."

The 1927 Act, so far as it relates to the conduct of trade disputes, declared certain kinds of strikes and lock-outs to be unlawful, and withdrew all the immunities conferred upon the unions by the 1906 Act in respect of actions done in contemplation or furtherance of an illegal strike within the meaning of the 1927 Act. This Act, however, covers many other aspects of legal disability imposed upon the unions (*see* LABOUR PARTY, LEVY, POLITICAL SOCIALISM). Under section I of the Act any strike or lock-out is illegal if it has any object other than or in addition to the furtherance of a trade dispute within the trade or industry in which the strikers are engaged; and is moreover a strike designed or calculated to coerce the Government either directly, or by inflicting hardship upon the community. This means in effect that "sympathetic strikes" (*see* STRIKES) are illegal, and anyone who declares, instigates or incites others to take part in such strikes are liable on conviction to a fine not exceeding £10 or to imprisonment for three months. The Act does not make a "general strike" illegal, but is aimed at sympathetic strikes and strikes which directly or indirectly seek to coerce the Government. Expenditure of trade union funds on unlawful strikes is made impossible by provisions in the Act which authorise the Attorney-General to apply for an injunction. "Peaceful picketing" is also limited by provisions of the Act which forbid one or more persons attending at or near a dwelling or place of business if they attend in such numbers as to be calculated to intimidate anybody in that place, or to obstruct, or lead to a breach of the peace. Penalties for violation of these provisions include a fine of £20 or imprisonment for three months with hard labour.—

BIBLIOGRAPHY: Books on legal aspects of Trade Unionism are numerous, but see particularly L. B. Ferguson, *Trade Disputes and Trade Unions*, 1927; Slesser and Baker, *Trade Union Law*; Slesser, *The Law Relating to Trade Unions*; S. and B. Webb, *History of Trade Unionism*.

TRADE-MARK. "A mark used upon or in connection with goods for the purpose of indicating that they are the goods of the proprietor of such trade-mark by virtue of manufacture, selection, certification, dealing with, or offering for sale." The law applicable to trade-marks in the United Kingdom is contained in the Trade Marks Acts, 1905 to 1919. A register is kept at the Patent Office, the Registrar being the Comptroller-General of Patents, Designs, and Trade Marks.

In order that a trade-mark may be registrable, at least one of the following particulars is essential: (1) the name of a company, individual, or firm used in a special manner; (2) the signature of the applicant for registration; (3) an invented word; (4) a word not geographical, not a surname, and not having reference to the character or quality of the goods; and (5) a distinctive mark or device.

All applications for registration are advertised, and any person may oppose the registration. Registration is for a period of fourteen years, but is renewable from time to time for a further term of fourteen years. An infringement of an unregistered trade-mark not in use prior to 13th Aug., 1875, does not carry any liability for damages. *See* MERCHANDISE MARKS ACT.

TRADE PROTECTION SOCIETIES. In Great Britain commercial associations were formed during the last quarter of the eighteenth century in Birmingham, Exeter, Halifax, Leeds, Liverpool, and Manchester, without any assistance or interference

from the State. Out of these has sprung the network of chambers of commerce, general associations, institutes representing particular trades and trade protection societies, which is now spread over the industrial areas of the country.

Organisations of the group last named represent retail as well as wholesale traders, and supply information as to the credit of firms, collect debts, and seek in various ways to promote trading interests. There are over a hundred trade protection societies in the United Kingdom.

TRADESCANTIA. A genus of lily-like plants, nat. ord. Commelinaceæ. The species are natives of America and India, and many of them are cultivated as ornamental plants in flower-gardens. They are well marked by three sepals, three petals, three-celled capsule, and filaments clothed with jointed hairs. *T. virginica*, a North American species, is known by the name of *spiderwort*. It has succulent stems, shining grass-like leaves, and blue or purple flowers, and it is common in the flower-borders of English gardens.

TRADE UNIONISM. The trade union is essentially a product of the eighteenth-century Industrial Revolution. Although associations of workpeople for mutual assistance and protection have existed since early times, the modern type of trade union does not date back farther than to the opening years of the nineteenth century when the wage-earners' organisations were legalised by the Repeal of the Combination Laws in 1824.

A trade union may be defined in legal terms as any combination, whether temporary or permanent, the principal objects of which are declared to be the regulation of the relations between masters and workmen, or between workman and workman, or masters and masters; or the imposing of restrictive conditions on the conduct of any business or trade and the provision of benefits to members. Under this definition combinations of employers as well as those of workpeople are trade unions. In effect, a trade union is a combination or organisation of persons united in pursuit of common aims to their own collective benefit in the trade or industry in which they are engaged.

At the beginning of the nineteenth century the British wage-earners had to fight a hard battle to secure the right to combine, and to use the power thus gained to improve their position. Anti-combination laws pressed heavily upon them, and even when the stringency of their provisions had been somewhat relaxed, the judicial interpretation given to such phrases as "peaceful picketing" continued to deprive the trade unions in great measure of effective operation. By a series of Acts of Parliament beginning in 1824, and culminating in the Acts of 1871-6, which constitute the legal charter of the unions, the right to strike, the provision of trade and friendly benefits, picketing and similar methods of action were legalised and union funds were protected. The Trade Disputes and Trade Union Act, 1927 (q.v.), altered the legal position of the unions very much to their detriment, not only in regard to the conduct of trade disputes but in respect of their political activities. For more than half a century the unions have taken an active interest in political questions, and since the beginning of the twentieth century have been organically connected with the Labour Party (q.v.) which was established by the Trades Union Congress in alliance with the Socialist societies in 1900 (*see* LABOUR PARTY, LEVY, POLITICAL SOCIALISM).

The political side of the Trade Union Movement has overshadowed the great work they do as friendly societies. They pay out to members large sums during times of illness and unemployment, and in connection with them are approved societies under the National Health Insurance Scheme. They also assist in working the National Scheme of Insurance against unemployment.

Trade Union Organisation. By the end of the nineteenth century the trade union movement in England had become crystallised in fairly definite forms. The "craft" union was the principal form of trade union organisation from about the middle of the nineteenth century until the rise of the great organisations of general labour (or unskilled and semi-skilled workers) in the closing decade of the century. Industrial Unionism (q.v.) and recent tendencies towards amalgamation of existing unions have brought very large and powerful organisations into existence, and the very active part played by labour organisations in politics are very characteristic of present tendencies. "Direct action," or the attempt to carry through fundamental modifications in the industrial and political structure of the country by the use of the strike on a great scale as an offensive weapon forms no part of the policy of the unions (*see* SYNDICALISM, LABOUR PARTY, SOCIALISM).

Trade Union Method. The essential feature of trade union organisation is the use of the organised power of the wage-earners to ensure their own

protection and to assist them in improving the conditions of employment. The principal methods employed by the unions include: (1) the practice of "collective bargaining," by means of which voluntary agreements are negotiated with employers or employers' organisations by union representatives, for the regulation of wages, working hours, and conditions of labour; (2) the provision of trade and friendly benefits, by the setting aside of a proportion of the members' contributions for the payment of certain sums in case of unemployment, sickness, accident, and old age (*see* UNEMPLOYMENT INSURANCE); (3) assistance to members in legal matters, such as claims for workmen's compensation (q.v.), and the settlement of individual grievances with employers through the mediation of union officers; (4) the establishment of political funds (*see* LEVY, POLITICAL) to enable the unions to engage in electoral activities and secure representation in Parliament; (5) the maintenance of relations with other bodies of organised labour, both national and international (*see* LABOUR AND SOCIALIST INTERNATIONAL; THE INTERNATIONAL FEDERATION OF TRADE UNIONS; SOCIALISM; the LABOUR PARTY). The trade unions function mainly, in dealing with the larger questions of industrial policy and relations with employers, by the method of conciliation and arbitration (*see* INDUSTRIAL NEGOTIATIONS). Strikes, or stoppages of work, are usually the last resort of the unions, and signify the breakdown or frustration of the often quite elaborate machinery of the unions for negotiating with employers (*see* STRIKES; SYNDICALISM). The machinery of "collective bargaining" to which the unions are parties embraces not only boards of conciliation and arbitration, but works councils, wage-boards, and similar joint bodies (*see* WHITLEY COUNCILS); and in recent years the Trades Union Congress, as representing the whole trade union movement, has entered into direct relations with the central organisations of employers (*see* MOND-TURNER CONFERENCES, etc.) for the discussion of the wider aspects of industrial policy and industrial relations.

One of the most important aspects of trade union method concerns the determination of wages. Trade unionism has influenced the course of wages very markedly since 1850. The influence of the unions is visible not only in the changes that have taken place in money rates of wages, but also in the rise of the level of "real" wages during this period (*see* WAGES AND WAGE MOVEMENTS).

BIBLIOGRAPHY: Sidney and Beatrice Webb, *Industrial Democracy*; G. D. H. Cole, *The World of Labour*, and *A Short History of the British Working-Class Movement 1789-1927*; A. C. Pigou, *Principles and Methods of Industrial Peace*.

TRADE WINDS. *See* GEOGRAPHY (section III: *Climate and Weather*); MONSOON.

TRAFALGAR. A low and sandy headland on the south-west coast of Spain, at the western entrance to the Strait of Gibraltar. The famous naval battle in which Nelson defeated a larger French and Spanish fleet under the command of Villeneuve and Gravina was fought on 21st Oct., 1805. The Franco-Spanish fleet lost 15 ships out of 33 in the actual battle; the British losses were nil, and in personnel amounted to only 449 killed.

TRAFALGAR SQUARE. Area in London. It was laid out to celebrate the victory of Trafalgar, and in it is the Nelson Column, 145 feet high, with a statue of the hero at the top and four bronze lions by Sir E. Landseer at the bottom. This was completed in 1867 and contains also some ornamental fountains and several other statues. On the north side is the National Gallery.

TRAFFORD PARK. District of Manchester. It is to the west of the city proper, on the Manchester Ship Canal, and is now an industrial centre with large engineering and other works. The estate was formerly the seat of the De Trafford family.

TRAG'ACANTH. A variety of gum familiary termed gum-dragon or gum-tragacanth. It is the produce of several species of the genus Astragalus, leguminous plants, natives of the mountainous regions of Western Asia. In commerce tragacanth occurs in small twisted thread-like pieces, or in flattened cakes, in colour whitish or yellowish, devoid of taste or smell. It is demulcent, and is used in coughs and catarrhs, and to make lozenges and pills. It is employed also in calico-printing and the thickening of milk.

TRAGEDY. A play or other literary work of a serious or sorrowful character, with a fatal or disastrous conclusion; often used as the antonym to comedy. The word is derived from the Greek τραγῳδία, a goat-song, so called either because a goat was the prize in early days, or because the actors were clad in goat-skins. (*See* article DRAMA, and such articles as ÆSCHYLUS, SOPHOCLES, EURIPIDES, SENECA, MARLOWE, SHAKESPEARE, WEBSTER, CORNEILLE, RACINE, etc.)

Greek. Greek tragedy arose from the dithyrambs or songs composed in honour of Dionysus. Its scope was extended in one direction or another by each of the three great tragedians whose work has been preserved. Aristotle's theory of tragedy is expounded with great clarity in his *Poetics*. According to him, "Tragedy is an imitation of an action that is serious, complete, and of a certain magnitude; in language embellished with each kind of artistic ornament, the several kinds being found in separate parts of the play; in the form of action, not of narrative; through pity and fear effecting the proper purgation of these emotions."

There are six elements in tragedy: three external, spectacular presentment, lyrical song, and diction; and three internal, plot, character, and thought. Plot, the representation of the action, is of primary importance. The plot must be a whole, and complete in itself. Pity is aroused by unmerited misfortune, fear by the misfortune of a man like ourselves; therefore a tragic hero should be neither entirely virtuous nor an utter villain, but a man who is not eminently good and just, yet whose misfortune is brought about not by vice or depravity, but by some error or frailty.

Aristotle put forward many suggestive speculations in his treatise; he did not intend to legislate for tragic poets for all time. Unfortunately many critics after the revival of learning treated the *Poetics* as a Draconian code from which there was no appeal. The notorious "unities" fettered tragedy until finally shattered by Coleridge, who pointed out that all rules are simply means to an end. If the ends are different, naturally the means are too. The Greek chorus could be brought to a place, but a place could not be brought to them without as palpable an equivoque as bringing Birnam Wood to Dunsinane; hence the need for unity of place is not felt when there is no chorus. If the law of actual perception is once violated—as it is in Greek tragedies—why is it more difficult to imagine three hours to be three years than to be a whole day and a half? Hence there is no need for unity of time. Coleridge went on to point out that Shakespeare only failed to conform with the *accidental* rules of the Greek drama. In spirit he is far nearer to Aristotle's rules than Corneille or Racine, though in letter he is far from any rules.

English. Elizabethan tragedy, properly so called, arose out of chronicle-history plays. Unity was secured in them by means of a central figure, and emphasis was laid on character. There was tragic situation but no tragedy before Marlowe. Anything mournful, cruel, or bloody is tragic, but not tragedy. Tragedy is a sequence of incidents or episodes, so presented as to emphasise with seriousness their causal relationship. Chance is predominant in comedy; in tragedy it plays a very minor part. Melodrama is inadequately motivated emotion, which stops at nothing to gain its effect.

As far as material goes, the great tragedies of Shakespeare might be classed with chronicle-plays. It is the *treatment* which distinguishes them. To the Elizabethans the tragedies seemed merely more masterly specimens of dramatic story-telling than the plays which had gone before; more masterly because they told in absorbing fashion stories involving the most intense and subtle emotions. Shakespeare had no theory of tragedy, so we cannot find one in him. *Macbeth* in a sense is Greek, i.e. it can be regarded as a fulfilling, struggle though the victim may, of a blind fate; *Hamlet* is a struggle between a man's temperament and his environment. In *Othello* there would have been no tragedy without Iago; in *King Lear* none without Goneril and Regan; so both of these tragedies are struggles of temperaments. Shakespeare discovered all the sources of tragedy, instead of assuming that it came from one source. Each new play with him was a fresh problem to be separately solved, though, of course, every conquest made his judgment surer. He invented no formula.

Pre-eminent in later Elizabethan drama was Ben Jonson, who wrote tragedies, not, however, with supreme success. Heywood, Dekker, Middleton, Beaumont and Fletcher, Massinger, and Shirley were other writers of tragedy.

With the growth of Puritanism, a feeling of hostility to the stage increased, and for a time the drama suffered eclipse.

Among the tragic dramatists of the "heroic" school of the Restoration drama, Congreve, who wrote *The Mourning Bride*, and N. Rowe may be singled out. Addison's tragedy *Cato* was written in blank verse.

After the classical tragedy of Dr. Johnson's generation came a period of dramatic decline in the nineteenth century, when the theatre and literature were completely divorced. Towards the latter part of the century, however, the theatre recovered its esteem, and men of letters did not hesitate to contribute to it.

Among modern dramatists, Sir John Galsworthy, Thomas Hardy, and R.

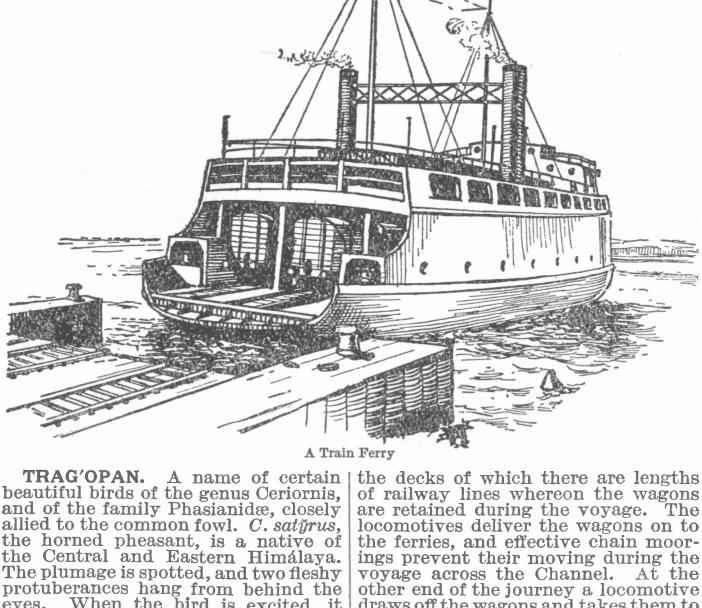
C. Sherriff are noteworthy writers of tragedy.

BIBLIOGRAPHY: A. H. Thorndike, *Tragedy*; W. L. Courtney, *The Idea of Tragedy*; S. H. Butcher, *Aristotle's Theory of Poetry and Fine Art*; S. T. Coleridge, *Notes and Lectures on Shakespeare*; A. C. Bradley, *Shakespearean Tragedy*; G. P. Baker, *The Development of Shakespeare as a Dramatist*; W. Archer, *The Old Drama and the New*; A. Nicoll, *British Drama*; A. Thaler, *Shakespeare to Sheridan*.

TRAG'OPAN. A name of certain beautiful birds of the genus Ceriornis, and of the family Phasianidæ, closely allied to the common fowl. *C. satyrus*, the horned pheasant, is a native of the Central and Eastern Himálaya. The plumage is spotted, and two fleshy protuberances hang from behind the eyes. When the bird is excited, it can erect these protuberances until they look like a pair of horns. *C. melanocephalus* is found in the Western Himálaya, *C. temminckii* and *C. caboti* in China, and *C. blythi* in North-East Assam.

TRAIN-BANDS. A force partaking of the nature of both militia and volunteers, instituted by James I. and dissolved by Charles II. The term was afterwards applied to the London Militia, from which the 3rd regiment of the line originated, and in which Cowper's John Gilpin was a captain.

TRAIN FERRY. The transit of goods from their place of manufacture to the docks by rail, followed by unloading and shipment by sea to the country of usage, where the same processes are reversed, is the source of considerable waste. The time taken in unloading the wagons, and restowage in the ships' holds may be eliminated by the use of train ferries. In the period of the European War, munitions were sent from Britain to France on this sytem. It consists simply in the use of ferry boats on



A Train Ferry

the decks of which there are lengths of railway lines whereon the wagons are retained during the voyage. The locomotives deliver the wagons on to the ferries, and effective chain moorings prevent their moving during the voyage across the Channel. At the other end of the journey a locomotive draws off the wagons and takes them to their destination. With the train-ferry system in use there is but one loading and one unloading as compared with three loadings and three unloadings in the ordinary system of transferring goods from an inland town in England to one in France, Holland, or Belgium.

There are some points in the design of the shore equipment which must not be overlooked. The fixed-level railway must be put into cummunication with the rails on the ship, whose height position is determined by the state of the tide and the load on the

vessel. It is obvious that the outer part of the jetties must be made in the form of movable bridges and provided with lifting equipment. In 1924 Great Eastern Train Ferries, Ltd., started a service between Harwich and Zeebrugge in conjunction with the London and North-Eastern Railway. Powerful train ferries are used by the Danish railways and on Lake Baikal.

TRAJAN, in full, **Marcus Ulpius Trajanus.** Roman emperor, born in Spain A.D. 53, died in 117. The son of Trajanus, a distinguished Roman commander under Vespasian, he served against the Parthians and on the Rhine, where he acquired so high a character that Nerva adopted him and created him Cæsar in 97. Nerva died in 98, and Trajan, who was then in Germany, peaceably succeeded to the throne. He made peace with the German tribes, and proceeded to introduce enlightened measures of reform into the public service. One of his greatest military achievements was his defeat of the Dacians, and the reduction of Dacia to a Roman province (*see* RUMANIA). It is supposed that it was in commemoration of this war that he erected at Rome the column which still remains under his name.

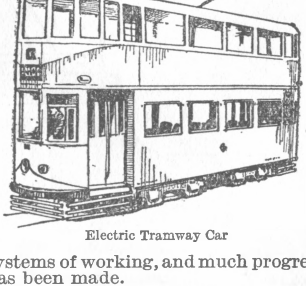
In 103 he wrote the famous letter to Pliny (q.v.), Governor of Pontus and Bithynia, directing him not to search for Christians, but to punish them if brought before him; and on no account to listen to anonymous charges. For some years Trajan occupied himself with the work of administration, but in 114 he set out on an expedition against the Parthians which resulted in the reduction of Armenia to a Roman province. He died at Selinus, in Cilicia, after having nominated Hadrian as his successor. He is said to have been sensual in his private life, but his good qualities as a ruler were such that even 250 years after his death senators greeted a new emperor with the wish that he might be more fortunate than Augustus and better than Trajan.

TRAJAN'S WALL. An ancient Roman fortified line of Bessarabia, Rumania, built between A.D. 105 and 155, extending from the Pruth eastwards to Lake Sasik or Kunduk. Another triple fosse extends from the Danube to Constanta, the greatest of which is ascribed to Trajan.

TRALEE'. A seaport-town of Kerry, Irish Free State, the county town, on the Lee; connected by canal with Tralee Bay. It has an active shipping trade in farm produce. Pop. (1926), 10,536.

TRAMMEL. An instrument for drawing ellipses, used by joiners and other artificers. One part consists of a cross with two grooves at right angles; the other is a beam-compass carrying two pins which slide in those grooves, and also the describing pencil. The semi-axes of the ellipse described are the distances of the tracing-point from the pins.

TRAMWAYS. The introduction of tramway traction marked a great development in convenient and comfortable travelling facilities within the large urban and suburban areas of our own and other countries. It is claimed for Birkenhead that the tramway system started there in 1860 was the first system in operation in Great Britain. Since that date many changes have been introduced into the



Electric Tramway Car

systems of working, and much progress has been made.

While tramway traction has at present, and had to a greater extent in the past when there was no satisfactory alternative, many advantages, the troubles caused through traction on fixed rails in large cities must not be lost sight of. In most of our towns the tramways are owned by the municipalities, and in too many cases have been developed and run without any consideration of traffic congestion, the rights of other users of the roads, and the costs of remaking the roads near those where the tramways operate, because of the deflection of heavy traffic from the main arteries to streets that were never constructed to deal with such loads.

In almost every large provincial city in Britain to-day there is a traffic congestion problem, due in some cases almost entirely to the use of tramways, and in every other, largely contributed to by the same agency. The introduction of double tracks in comparatively narrow roads should be avoided, and in fact only used when the road is wide enough to permit the passage of two lines of ordinary traffic in the space between

the tramway zone and the kerbstone. Double-track crossings at busy centres in the heart of a city should be avoided. With these limitations the advantages of tramway traction may be obtained without the expensive congestions that are quite common. It is doubtful, however, whether the use of motor-buses does not afford a better solution of the problem of transporting the people between their homes and their business places. In some cases the advantage undoubtedly rests with the motor-bus, but there are others where the position is not quite so clear.

The proposals for a tramway scheme must be submitted in a Bill to Parliament. Powers are only granted after the system proposed and the manner of its application have been submitted to discussion and the possible opposition of the interests affected. By-laws regarding equipment have been framed, and all the construction is subject to the inspection of the Board of Trade before the system is approved for working.

Almost every type of propulsion scheme has been applied to the operation of tramways: steam traction engines, gas and petrol engines, and electric motors. Except in a few isolated cases the electric system has prevailed, and the common arrangement is to convey the power through an overhead conductor and use the tram rails as the return, but there are also some installations in which the cable is housed in a conduit below the surface of the road. The equipment in use has become practically standardised the world over.

The electricity supply is usually at 500 volts, but pressures as high as 750 have been put into service. Wheeled trolleys or bow collectors convey the electricity from the overhead wire to the controller, through which it can be passed to the power units. Drum controllers are the common type, and they are wired to permit of the connection of the motors in series or in parallel, with resistances at first, but later cut out in sections. Two motors of 30 to 40 h.p. having series winding, with four poles and sometimes interpoles, constitute the usual equipment. Effective braking is essential, and is commonly worked by air or by the conversion of the electric motors into generators to energise magnetic rail brakes, but hand brakes are fitted as spares.

The trolley lines are divided up into sections separated by insulators and fed from cables connected with the central or sub-station through section switches in pillars beside the line. The wire is supported on spare wires, side brackets, or centre poles. Guard wires are run above the trolley wires to afford protection from contact with falling wires or trees. As limits have been placed by the Board of Trade on the maximum drop in pressure in tramway rails, it is common to provide copper bands at the rail junctions, the rails being frequently welded together at these points. As earth leaks may cause corrosion of pipes in the ground, their magnitude is limited by regulation. The corrosion is caused by the current entering and later leaving the buried pipes in its travel back to the supply station.

The conduit system costs much more for its installation than the overhead system, the disparity varying according to the locality and the conditions, but cases have been noted where the conduit scheme cost 80 per cent more than the common overhead equipment. The slot of the conduit usually occupies the mid position between the rails, but there are examples on the Continent where the slot is at the side and serves as the groove in the ordinary tram rail. The conductors are mounted on insulators in the conduit, and the connection is made to them by cast-iron shoes pressed to the conductors by semi-elliptical springs. A combined use of conduit and trolley-wire systems has been made in some few cases, but not always with success.

In large cities cars are made with two decks to accommodate more passengers. Sometimes they move underground for part of their journey, a notable instance being the London subway from the top of Kingsway down to the Victoria Embankment. Some towns (e.g. Nottingham) have adopted a trackless, overhead tramway system, the vehicles being fitted with pneumatic tyres.

TRANCE. A condition resembling sleep, in which consciousness and many of the vital functions are suspended, and during which the action of the heart is diminished and the breathing reduced. The subjects of trance are usually hysterical, and in some cases the condition is induced by exhausting disease or emotional disturbance. During a trance the face is pale, the limbs relaxed, the mental functions are in abeyance, and no effort at rousing will produce a return to consciousness. This state may last from a period of several hours to many weeks or months. When the trance lasts for a lengthy period, food is taken in a mechanical way at intervals by the sleeper. Most cases recover. The term is also applied to a sort of ecstatic state into which some persons are said to fall, and in which, while unconscious of what is

passing around them, they have remarkable dreams or visions.

TRANENT. A burgh of East Lothian, Scotland. It is a colliery centre. Pop. (1931), 4526.

TRANI (ancient **Turenum**). A coast town of Apulia, South Italy, in the province of Bari, on the Adriatic; served by the Ancona-Brindisi Railway. Pop. 32,060.

TRANQUEBAR'. A seaport in the district of Tanjore, Madras Presidency, India. It was made a Danish settlement in 1616, and sold to the British in 1845. The town was the first settlement of Protestant missionaries in India. Pop. 13,300.

TRANSBAI'KALIA. A former province of the Far Eastern Area (*see* RUSSIA); it now forms part of the Mongolo-Buirat U.S.S.R.

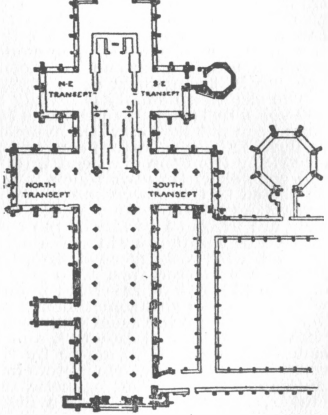
TRANSCASPIA. A former Russian Asiatic province extending along the eastern shore of the Caspian Sea, now in the Uzbekistan and Turkmenistan S.S. Republics.

TRANSCAUCASIA. A former Russian lieutenancy south of the Caucasus (and therefore in Asia Minor), which comprised the governments of Black Sea, Kutais, Tiflis, Baku, Erivan; the provinces of Elisavetopol, Batoum, Kars; and the districts of Zakatali and Sukhum; total area, 95,400 sq. miles. It is now divided among the Republics of Armenia, Azerbaijan, and Georgia. The chief rivers of the region are the Rion and Kura; the mountains are treated under CAUCASUS. Ethnologically considered, the chief people are the Russians, Georgians, Armenians, and Tartars, but the general population forms an extraordinary olla-podrida of nationalities. The population (pre-Revolutionary) was 7,500,000. Towns of importance include: Tiflis, Baku, Novorossiysk, Elisavetopol, Erivan, Kutais, and Batoum. See the next article.

TRANSCAUCASIA. The Transcaucasian Socialist Federal Soviet Republic of the U.S.S.R. (*see* RUSSIA) comprises the republics of Azerbaijan, Armenia, and Georgia (all of which see); area, 71,255 sq. miles; pop. (1926), 5,850,692. These were federated in 1922, the constitutions of the federation and of the separate republics being in essentials the same as those outlined under Russia (q.v.). Tiflis is the federal capital.

TRANSCENDENT and **TRANSCENDENTAL.** Philosophical terms employed by the Scholastics and applied to notions wider than the Aristotelian categories, as being, goodness, or unity. Kant applied the term *transcendental* to all those principles of knowledge which are original and primary, and which are determined a priori, such as space, time, and causality. Although not products of experience, they are manifested in experience, but go beyond empiricism, i.e. transcend it. By *transcendent* Kant understood all that lies *beyond* the limits of experience, and is thus inaccessible to it.

TRANSCENDENTALISM. The term applied to the philosophy of Kant and to any other systems which, without exactly considering experience as untrustworthy, dwell in the regions beyond experience, and maintain that there is a knowledge of transcendental elements, or a priori conditions of experience. The term transcendentalism is also applied to the New England movement originated by Ripley, Emerson, and others, whose ideas transcended reason, and who laid stress on the intuitive and the mystic. They were influenced by German idealism and French sociological doctrines, and were opposed to conventionalism and formalism. Economically, they were inclined to socialism, and made an experiment in the famous Brook Farm (q.v.).—Cf. H. C. Goddard, *Studies in New England Transcendentalism.*



Transept

TRANSEPT (Lat. *trans*, across; *septum*, enclosure). In architecture, the transverse portion of a church which is built in the form of a cross; that part between the nave and choir which projects externally on each

side, and forms the short arm of the cross in the general plan. *See* CATHEDRAL.

TRANSFORMER. Any type of electric plant by which the pressure may be changed. The common usage is to apply the term to those stationary units installed to change the pressure of alternating-current supply, but it might reasonably be extended to cover the transformations effected by rotary converters in producing direct currents from alternating currents or to rectifiers by means of which unidirectional currents may be obtained from the same source.

A simple single-phase transformer has two distinct coils, known as the primary and the secondary, wound upon an iron core built up of wire or thin sheets in order that eddy currents within it may be kept down to a minimum. The factor which fixes the magnitude of the change of pressure is the ratio of the number of turns on the two coils. Similar alternating currents to those in the primary winding are induced in the secondary circuit, at a different pressure. If the circuit supplies polyphase currents, similar ones may be produced at lower or higher pressure by transformation, the separate phases being dealt with in coils each on its own core.

The possibility of effecting pressure transformation of alternating currents by stationary plant is of great economic advantage, and it is for that reason that electricity is generated at high pressure for transmission, with resulting small losses, and transformed to low pressures for delivery to consumers. The common arrangement is to produce three-phase currents at high potential—6500 volts is a common value—and to send that supply out to sub-stations scattered over the district. When the consumer receives an alternating-current supply, the pressure may be fixed to suit the conditions of the work to be done, but generally three-phase supply at 440 volts is the standard. If direct current is necessary, it can only be obtained by the use of rotating plant of the rotary converter or motor generator type. In the plant first mentioned both the alternating-current input and the direct-current output are dealt with by the same rotor, but separate machines directly coupled comprise the second system.

Most high-pressure transformers are immersed in oil in a tank usually built up of steel plate welded into the form desired. The heat from the coils is taken up by the oil and radiated from the ribbed surface of the tank. Water cooling for the oil may be used to assist the process. The oil used for the purpose must be free from even traces of water, otherwise the insulation resistance of the coils will be greatly reduced. In addition to their use for changing the pressure of a supply system, transformers are used for many other purposes. For starting alternating-current motors, a single-coil-device known as an auto-transformer is sometimes used. They are connected across the full pressure of the supply, and tappings may be taken from various points on the coil to obtain different pressures. Another use is for the instruments in alternating-current power supply stations. Step-down transformers giving low pressures are in common use for that purpose.

Rotary converters have some advantages over the complex separate machines known as motor generators, in cost, compactness, efficiency, and commutation. An induction motor is commonly installed on the rotary converter shaft to bring it up to speed. Starting from the alternating-current supply or from the direct-current side of the system is possible with a motor generator.

Rectification of an alternating current is possible by the use of a commutator driven at the speed of synchronism. Another method is to use an alternating-current electro-magnet to oscillate an armature which is suitably pivoted and gives reversal of the connections with the reversal of the current. When an aluminium electrode is placed in a concentrated solution of neutral ammonium phosphate, carbonate, or oxalate, current will flow through it to any other electrode in one direction only. The action depends upon the effect of a film of aluminium hydroxide. Ionised mercury vapour has the property of conducting electricity in one direction only, and is used for rectifiers of small power. See section on *Thermionic Valve* in article WIRELESS TELEGRAPHY ; INDUCTION COIL.

TRANSFUSION. The transmission of blood from the veins of one living animal to those of another, or from those of a man or one of the lower animals into a man, with the view of restoring the vigour of exhausted subjects. This operation is a very old one, but seems to have generally ended in failure until about 1824. Recent researches have shown that the blood of human beings differs in different individuals, there being several *groups* of both blood corpuscles and sera. These *groups* are not all compatible with each other. Hence a suitable *donor* must be identified before proceeding to transfusion. *In-*

fusion of suitable bland solutions is also commonly practised. Remarkable results were achieved by both methods during the European War.

TRANSIT. In astronomy, (*a*) the passage of a heavenly body across the meridian of any place, a phenomenon which is usually noted by a transit instrument. The determination of the exact times of the transits of the heavenly bodies across the meridian of the place of observation enables the astronomer to ascertain the differences of right ascensions, and the relative situations of the fixed stars, and the motions of the sun and planets parallel to the celestial equator. (*b*) The passage of one heavenly body between a larger heavenly body and the observer's position, so that it appears to traverse the disc of the latter body. The term is chiefly used of transits of Mercury and Venus across the sun's disc, or of Jupiter's satellites across that of their primary. Transits of Venus are of rare occurrence, four taking place in 243 years, at intervals of 8, 122, 8, and 105 years. On account of the position of the nodes of the orbit, they can occur only on or near the dates 5th June and 7th December. A pair of December transits occurred in 1631 and 1639, and another in 1874 and 1882. The last June transits were in 1761 and 1769; the next will be in 2004 and 2012. The longest duration of a transit of Venus is about eight hours.

The path across the sun as seen from different terrestrial view-points is different, and a method based on the comparison of such observations was formerly the most accurate means of measuring the sun's distance, and was that by which a tolerably correct determination was first obtained. The results in 1874 and 1882 did not come up to expectation, and it became evident that this method is much inferior to others which are now available. The drawback lies in the difficulty of noting the exact instants of the planet's ingress and egress upon the sun, on account of an encircling luminous ring due to its atmosphere, and also on account of the optical phenomenon of the "black drop," a ligament which seems to connect the planet with the sun's limb for a moment at each internal contact. Venus when in transit can be observed by the eye, through darkened glass; transits of Mercury, which occur much more frequently, can be seen only with telescopic aid.

TRANSIT CIRCLE, or MERIDIAN CIRCLE. An important astronomical instrument adapted for observing the exact time of the passage of heavenly bodies across the meridian, and the altitude at which they cross it. A horizontal axis is supported upon pivots carried by two fixed piers which have deep foundations and are out of connection with the surrounding floor. The horizontal axis is in an east and west direction, and as the telescope tube is at right angles to it, the telescope turns in the plane of the meridian. A frame carrying "wires" of spider thread is placed in the focal plane, and the observer notes the time at which the image of the star or other object is seen to cross each wire. The average of these times, properly reduced, gives the time on the clock at which the object crossed the meridian.

There is attached to the horizontal axis a large and accurately graduated circle, which turns with it. By means of this circle, the graduations of which are viewed through fixed reading microscopes, the exact position in which the telescope is pointing, and thence the meridian altitude of the body observed, can be determined. If the instrument is designed only for observing times of transits, and not altitude, it is called a *transit instrument* (q.v.).

TRANSIT INSTRUMENT. This is an instrument of the same principle of construction as the transit circle (q.v.), except that it is not provided with the large graduated circle and reading microscopes for obtaining the exact altitude of an object observed. Its use is therefore confined to observing the instant of an object's transit across the meridian, but with that exception the account of the transit circle may be taken as applying to the transit instrument, and the following remarks are supplementary and relate to both instruments.

Theoretically, the optical axis of the telescope should revolve exactly in the plane of the meridian, passing through the nadir, the north point of the horizon, the pole of the heavens, the zenith, and the south point of the horizon. However nicely the adjustments are made, this can never be exactly attained, and therefore in practice the errors are first reduced to very small amounts, and then are accurately determined, and allowances made for their effects on the results of observations.

There are three kinds of error: (1) error of inclination, or level, one of the pivots for supporting the telescope axis being higher than the other; (2) error of azimuth, one of the pivots being slightly farther south than the other; (3) error of collimation, the optical axis of the telescope not being precisely at right angles to

the axis of revolution. These errors of the instrument must be frequently ascertained; where great accuracy is necessary, they must be ascertained afresh on every occasion of an observation.

The several errors are found by various methods: by the use of collimators (q.v.), by a striding level, by observing the coincidence or amount of separation of the wires and their images as reflected through the telescope from a trough of mercury below the instrument, and by observations of the Pole Star. The telescope can be reversed in its bearings so that the (formerly) west end of the axis rests upon the eastern pivot. This is useful in the process of determining the errors. Also if two stars are observed for time, the instrument being so reversed between the observations, inaccuracy due to imperfect allowance for the instrumental errors can to a large extent be eliminated in the mean result.

The following expresses in brief the result of an observation for time actually taken at an observatory on 23rd Aug., 1922. The star observed was α Herculis.

	Hr.	Min.	Sec.
Observed time[1] of transit by sidereal clock	17	9	56·46
Correction[2] for collimation error			+0·11
,, inclination ,,			+0·20
,, azimuth ,,			+0·05
Corrected time of transit by sidereal clock	17	9	56·82
Star's right ascension	17	11	7·65
Error of clock		1	10·83 slow

[1] Recorded by chronograph (q.v.), the transit being observed over thirteen wires.

[2] These corrections are computed for the particular star, as they vary with the declination.

As a rule the sidereal clock is readjusted only at very long intervals, but careful attention is always paid to its error and rate. By an intercomparison of the sidereal and mean time clocks, the mean time clock error is then found, and any necessary adjustment can be made. In this instance the error of the mean time clock was found to be 0·11 of a second different from what it had been estimated to be immediately prior to the observation, judging from the error of the standard sidereal clock as determined by stellar observation a few days previously and its assumed rate in the interim.

TRANSJORDANIA, or KERAK. An independent emirate of Arabia, extending eastwards from the Jordan and the Dead Sea (Palestine boundary) into the Syrian desert, and lying between the River Yarmuk and Syria on the north and the Hejaz in the south. The boundaries are so indeterminate that no estimate of area is possible. In 1925, by the Hadda Agreement (negotiated by Sir Gilbert Clayton with Ibn Saud, Sultan of Nejd), the boundary between Transjordan and Nejd was fixed. The vilayet of Ma'an (formerly in the Hejaz) was transferred to Transjordan, which has thus an outlet to the Red Sea (Gulf of Akabah). The population is *c.* 260,000 (220,000 Arab Moslems, 30,000 Arab Christians, and 10,000 Caucasians settled by the Turks after the Turco-Russian War, 1878). Traversing the country from N.W. to S.E. is the great depression, the Wadi Sirhan.

Prior to the European War Transjordan was part of Turkish Asia, but it was included in the Palestine mandate to Britain (approved by the League of Nations in 1922). In 1921 Abdullah (brother of King Feisal of 'Iraq) became Amir. By agreements signed in 1923 and 1928 Britain (while preserving her own position in the country) made recognition of an independent administration in Transjordan, provided that the government was conducted on constitutional lines, and that the approval of the League of Nations was secured. The High Commissioner for Palestine is responsible for Transjordan, and the British representative in Transjordan has been since 1924 the supreme authority in the country. Transjordan receives an annual grant-in-aid from Britain.

The Cairo to Bagdad air route and the Hejaz Railway traverse the country; between the latter and the western boundary is a fertile strip (*c.* 30 miles wide) where agriculture is practised. Elsewhere the country is mainly desert, though the pastoral industry is prominent. There are large undeveloped phosphate deposits, and potash is found in the Dead Sea. The capital, Amman, is on the Hejaz Railway, has a Royal Air Force aerodrome (in connection with the Cairo-Bagdad Air Route), and is joined by motor road to Jerusalem. The largest town is Es-Salt, which is the centre of an agricultural and wine-growing district. Other towns are Madeba, Hesban, Ma'an, and Al-Kerak. There is a defence force of 700 men (the Arab Legion) under a British commandant.—Cf. Mrs. Steuart Erskine, *Transjordan.*

TRANSJUBA. *See* JUBALAND.

TRANSKEI. An eastern district of Cape Province, Union of South Africa, forming part of Kaffraria.

TRANSMIGRATION OF SOULS. The doctrine which teaches that after the death of the body the soul passes through the bodies of the lower

animals or other human bodies, or even through plants and inanimate objects. The belief in the transmigration of souls, which results from the doctrine of totemism and from the belief that after death man rejoined his totem, is not only common in primitive animistic religions, but forms also a part of certain advanced religious systems, where it is connected with the ideas of immortality and of retribution.

In the teaching of the Brahmanic Hindus the doctrine has its foundation in the belief of the connection of all living beings, and of the gradual purification of the spiritual part of man and its return to the common source and origin of all things—God. It is the means by which *Karma*, or the law of moral retribution through a series of rebirths, takes place.

The doctrine formed part of the secret teaching of the Egyptian priests, and it was from Egypt that it passed into Greece. Pythagoras, who is supposed to have remembered his experiences in his previous states, was the first to teach the doctrine in his system, although Thales and Pherecydes are both said to have preceded him in teaching it. Plato, in his *Phædo* and in the *Republic*, supports the doctrine, and it forms part of the philosophical system of neo-Platonism. The doctrine has been advocated by Lessing (q.v.).—BIBLIOGRAPHY: F. B. Jevons, *Introduction to the History of Religion*; A. Bertholet, *Transmigration of Souls*.

TRANSPORT, or the business of carrying a person or thing from one place to another, is as old as humanity. From an early age pack animals were employed for transport, followed by the primitive sledge and raft. Wheels and canoes developed slowly into the era of stage coaches and sailing craft through many ages. Roads, rivers, and canals also came into service, but until the advent of the steam engine 145 years ago progress in transport was slow.

In 1825 George Stephenson applied the steam engine to land transport on the first public railway in the world between Stockton and Darlington. As early as 1807 the steam engine was applied to river transport by Robert Fulton, and in 1812 Henry Bell built a passenger steamer for the Clyde.

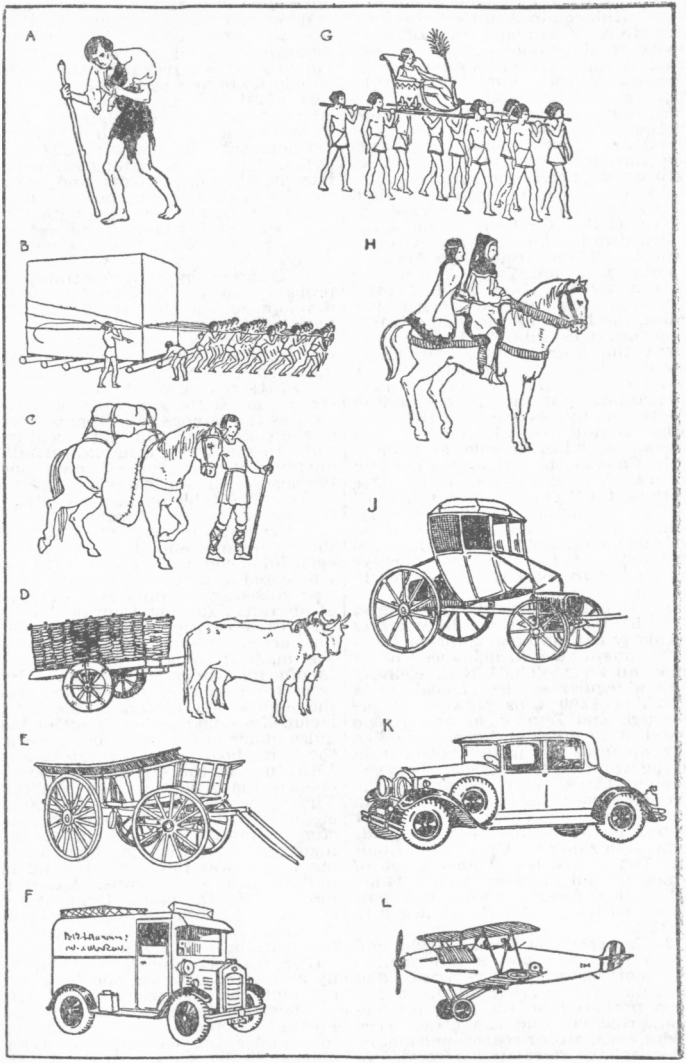
With the development of the steam locomotive and prepared railway track, and the sea-going steamship, enormous changes in civilization took place throughout the world. There are now three-quarters of a million miles of railway lines laid down in various countries. Electricity was used for the purpose of railway haulage in 1890, when the first electrically operated tube railway was opened for traffic between the Bank and Stockwell in London. Since that time seven thousand miles of railway tracks have been electrified by adding extra or "third" rails or overhead wires bringing electric current within reach of electric locomotives and trains, apart from tramway services in the streets of towns and cities.

The commercialisation of the internal-combustion engine by Gottlieb Daimler in 1885 led to the motor-car and aeroplane, whilst the electric storage battery and electric motor has solved the problem of transport beneath the surface of the sea.

The following is a summary of the present position of the more important means of transport.

1. Transport by Rail. The most powerful British passenger locomotives can haul trains of between 500 and 600 tons at speeds of 70 to 80 miles an hour. The best passenger services are arranged between the more important towns and cities, an average of ten to twelve departures being available every twenty-four hours. Sunday rail services in Britain, unlike the Continent, are much less frequent. By the Railways Act, the resources of the railways have been divided into four Groups, with a separate Passenger Transport Board for London and twenty-five miles around. Each of the Groups has developed excellent express services to and from London. For example, the "Flying Scotsman" expresses leave London and Edinburgh each week-day at 10 a.m., taking 7½ hours to cover 392·7 miles. In summer these trains bridge the whole distance without stopping, constituting the longest non-stop railway runs in the world. Other daily long runs are between Euston and Carlisle, 301 miles, and between Paddington and Plymouth, 225·7 miles. There are in addition 146 trains which have non-stop runs of over 100 miles, and 11 of these are in excess of 200 miles. More express trains travel at 55 miles an hour average in Britain than in any other country.

On the Continent, Empire lands, and the United States, passenger locomotives greatly exceed in power anything known or required in this country. Trains are heavier, and many of the lines have the advantage of larger loading gauges, both lateral and vertical. In Europe, by close working arrangements between the nations, trans-continental expresses, such as the "Orient Express" between Calais and Paris and Istanbul (Constantinople), the "Rome Ex-



TRANSPORT

A, Man carrying goods. B, Egyptian Roller. C, Pack Horse. D, Early Ox Cart (11th century). E, 17th Century Cart. F, Motor Van. G, Egyptian Litter. H, Pillion. J, Chaise. K, Saloon Car. L, Aeroplane.

press" between Paris and Rome, and the "Rhinegold Express" between the Hook of Holland and Basle in Switzerland, provide through services used by the nationals of all countries. Remarkable rock tunnels through the Alps, by the Simplon and St. Gotthard routes, are amongst the wonders of the world, the 105 miles length of the St. Gotthard Railway representing the most wonderful stretch of railway engineering in Europe.

As examples of typical United States express passenger services the "Twentieth Century" and the "Broadway Limited" may be mentioned. These trains run between Chicago and New York. The former is run by the New York Central Railway, the distance being 978 miles, the latter by the Pennsylvania Railway, 908 miles. By arrangement the journey takes 20 hours, the west bound "Twentieth Century Limited" making the longest daily non-stop railway run in the American Continent, by covering the 183 miles from Buffalo to Cleveland at an average speed of 51 miles an hour.

In Canada through trains are run from the Atlantic to the Pacific. One of these, the "Trans-Canada Limited" of the Canadian Pacific Railway, takes 3¾ days to cross from Montreal to Vancouver, and the "International Limited" enables through journeys from coast to coast to be achieved in 4¾ days.

In Goods Transport, the largest British goods steam locomotives regularly haul mineral trains of 1000-1200 tons at a schedule speed of 25 miles an hour. The L.N.E. Railway runs a regular service of coal trains weighing 1200 tons between Peterborough and London at an average speed of 20 miles an hour. This line also operates the fastest goods train in the world every week-day, between King's Cross and Glasgow, the average speed being 39·5 miles an hour excluding stops. The next fastest is the "Blue Streak" goods express in America, between St. Louis and Texarkana, the average speed of which is 33·6 miles an hour. Time-tables for freight trains are now issued to traders by the railways in Britain.

2. **Transport by Road.** Light and heavy road transport is now carried by motor-cars, motor-lorries, and trailers. The touring motor-car has been produced on the mass production principle, and can attain very high speeds. Motor-coaches and motor-saloons have developed a service of passenger transport throughout the main roads of this country. By co-ordination with the Railway Groups, many of these services are being dovetailed in with the train services, making rail and road door to door journeys practicable. The touring motor-car is used for countless individual journeys over the roads. The popularity of road services and motor-cars privately owned has made accessible hitherto hidden highways and by-ways and made possible housing developments in country districts. Colour light signal systems are being introduced at cross roads, and owing to the alarming number of road accidents, Government regulation of road transport has been necessary. Further legislation on this subject is likely.

3. **Transport by Sea.** Sea-transport probably reaches its highest point of development in the North Atlantic trade. In luxury of accommodation, comfort of travel, amusements, business facilities, and in speed the famous liners in the North Atlantic trade leave little to be desired. These liners occupy much the same position, to-day, as the famous tea-clippers, such as the *Cutty Sark*, did half a century ago. In the article SHIPPING, details are given of speed, type of power, and tonnage for the world's twelve largest ships. The table on p. 295 contains further particulars of some of these.

4. **Transport by Air.** The claims of the aeroplane and the airship as agencies of commerical transport were vindicated in 1919, when the Atlantic was crossed successfully by both types of aircraft. Regular Continental air services have run since 1919. The first actual crossing of the Atlantic was made in 1919 by an American, Lieutenant-Commander Read. He came from America to England, via the Azores and Lisbon. This flight included a remarkable passage of 150 miles under power on a rough sea in the flying-boat N.C.4. On 14th and 15th June of the same year, Alcock crossed the Atlantic on a Vickers-Vimy aeroplane with twin Rolls engines in 16 hours 12 minutes, non-stop. Hawker had attempted the flight on a Sopwith machine previously, but was forced to descend in mid-Atlantic. He was, however, rescued. In the late autumn of the same year Ross-Smith and his brother flew another Vickers-Vimy machine to Australia in 28 days.

The R 34 was the first airship to fly across the Atlantic and back. It accomplished the whole round trip in under eleven days. She left East Fortune Aerodrome, in Haddington, under the command of Commander G. H. Scott, C.B.E., A.F.C., at 1.48 a.m., Greenwich time, on the 2nd July, 1919, and landed at Mineola, Long Island, New York, at 2 p.m., Greenwich time, on the 6th of July.

The time taken was thus 108 hours for a total distance of 3600 British statute miles, giving an average speed of 33¼ miles per hour. The weather encountered was very unfavourable, a heavy storm being met with shortly after leaving the Irish coast, and a severe thunderstorm over New Brunswick. After refilling and provisioning, the return journey was commenced at 3.45 a.m., Greenwich time, on 10th July, and finished at Pulham, Norfolk, at 6.57 a.m. on the 13th of July. The distance covered on the return journey was 3450 statute miles, and the average speed 46 miles per hour.

The following are some particulars of the Imperial Airways Air Liner Services which now own and operate

Steamer.	Length.	Beam.	Draught.	Horse Power.	Carrying Pass.	Capacity Cargo.
	Feet.	Feet.	Ft. In.			Tons.
Majestic ex Bismarck	954·5	100	38 11½	66,000	900 1st 725 2nd 2438 3rd	954
Aquitania	902	96·5	36 2	56,000	757 1st 635 2nd 1300 3rd	2393
Olympic	882·7	92·5	34 7	55,000	947 1st 493 2nd 1254 3rd	2091
Mauretania	787	87·5	36 2½	68,000	589 1st 399 2nd 767 3rd	1092
Homeric	776·75	83·5	35 3½	28,000	443 1st 610 2nd 1758 3rd	7597

40 aircraft with a total horsepower of 58,060. During twelve months the aircraft of these services, which maintain a regular service between London (Croydon) and Paris, London and Cologne, London and Zurich, London and Cape Town, and London and Karachi (India), flew 1,722,000 miles. The services cancelled on weather account and for all other reasons amounted to 2·89 per cent of the scheduled services, as compared with 23 per cent in 1924, the first year of operation of the Imperial Airways Services. The route mileage operated by regular services is now 12,000 miles.

The Empire Services operated by Imperial Airways now make contact with nineteen countries in three different Continents. The first Empire Route—London to India service—is part of a through route to Australia, negotiations being in train for extending the service to link up with the Commonwealth. Transatlantic routes for air services to Trinidad, Bermuda, and Canada are projects which are being investigated, leading eventually to an alternative route to the Far East, and an all-British Empire Service around the world.

Air liners are now fitted with three and four engines, and are luxuriously equipped. Closed cabins with cushioned arm-chairs for passengers are provided, and there is freedom to move about when desired. Luncheon and tea are served in the air from a small buffet or kitchen, and ample toilet accommodation is provided. With crew, passengers, and luggage a modern air liner weighs six tons, and can travel at 120 miles an hour. Constant contact with land radio stations is maintained throughout each flight, and the weather conditions ahead are obtained. Strict safety regulations are enforced by the Air Ministry regarding British passenger carrying aircraft. *See* TRAMWAYS; STEAM-ENGINES; INTERNAL-COMBUSTION ENGINES; LOCOMOTIVES; ROADS AND PAVEMENTS; SHIPBUILDING; SHIPPING.

TRANSPORT, MINISTRY OF. Administrative department of Government established by the Ministry of Transport Act, 1919, for the purpose of improving the means of locomotion and transport in the United Kingdom. All the functions of other Government departments in relation to railways, tramways, canals, roads and bridges, harbours, docks, etc., were concentrated in the hands of the new ministry. Power was given to establish and work transport services by land or water. The ministry was responsible for the scheme of railway reorganisation which came into operation in 1921. Separate departments deal with development, traffic, roads, finance, etc. The work of the ministry has been severely criticised, and the Geddes Economy Committee in 1922

recommended its absorption by the Board of Trade.

TRANSPORT AND SUPPLY, MILITARY. The tribesman of the North-West Frontier of India or the negro of the African forests, living under much the same conditions as have held good for hundreds of years, can still exist on a handful of parched grain or a few sweet potatoes or *yams*, and the conditions of his life make it possible for him not only to exist but to do hard work on very scanty fare, which he can carry for himself. He is, in fact, his own supply and transport.

Modern armies, on the other hand, are composed of men who are accustomed to live a gregarious life in town or country, and who, from their upbringing, would be practically helpless if left to themselves; moreover, the organisation and size of an army, and the requirements of discipline (without which an army would be merely an armed rabble), make individual or promiscuous foraging an impossibility. The oft-quoted dictum that "an army, like a serpent, goes on its belly" attributed to Frederick the Great of Prussia, or that of the great Duke of Marlborough, who is said to have expressed the same axiom in the words "No soldier can fight unless he is properly fed on beef and beer," is as true now as when it was made, and the complexities of "supply" and "transport" are far greater now than they were in the eighteenth century. The comparatively small armies of those days could and did live largely on the country in which they were operating; at the present time, the far greater proportion of all the needs of an army has to be brought from other countries. The army still "goes on its belly," and though Marlborough's "beer" has now become "rum" and his "beef" is enclosed in tins or frozen, yet this only complicates the question, as the "beef" has to be carried instead of being driven "on the hoof," as is still the custom in India, where, for reasons of caste, meat for Indian troops must be killed by the troops themselves.

In the British service the administrative service which is charged with the provision of "supplies" (i.e. food, forage, fuel, light, and disinfectants, to use the official definition) and "transport" is the Royal Army Service Corps; in India it is known as the Supply and Transport Corps. In former days all questions of supply, when they were attended to at all, were left to the tender mercies of a "commissariat department," the organisation of which was, to all intents and purposes, civilian, the officials being known as "commissaries" of various grades. Some time in the 'eighties of last century this civilian or semi-civilian department of the army was abolished, and from its ashes rose the Army Service Corps, an entirely military department.

For its outstanding services in the European War the corps was awarded the prefix "Royal." The Royal Army Service Corps is divided into two main branches, "supply" and "transport." These are again subdivided into "companies," those of the supply branch being lettered, and those of the transport branch numbered. The transport branch is further divided into "horse transport" and "mechanical transport."

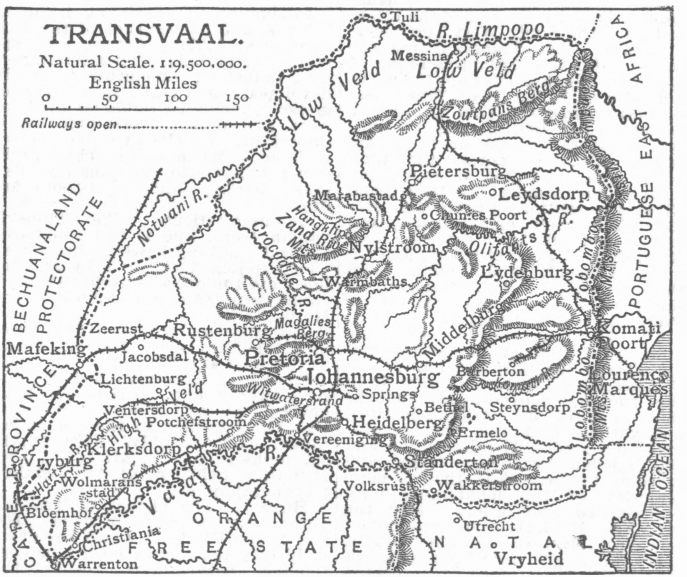
All general questions of supply and transport are dealt with by the Department of the Quartermaster-General to the Forces at the War Office — the Quartermaster-General himself being a member of the Army Council—and a Director of Supplies is in charge of one of the principal subdivisions of the department.

TRANSPORTATION. A system of punishment for crime by removing the criminal to a penal settlement beyond the seas. The origin of transportation is to be found in the practice formerly adopted by sovereigns of banishing for a term or for life those who seriously offended them, or of allowing those who had committed a crime and had taken sanctuary to escape abroad. The system of transportation was given statutory sanction by the Vagrancy Act of the reign of Elizabeth, and in the reign of Charles II. it was extended to include, on the one hand, incorrigible rogues, vagabonds, and sturdy beggars, and, on the other hand, those who after a first conviction continued to attend illegal prayer meetings.

At first those sentenced to transportation were allowed to remove themselves out of the country within a specified time under threat of hanging, but from 1718 until the American War of Independence it was the custom to transport such convicts to the American colonies, there to labour as slaves on the plantations. The system was opposed by the colonists, and with the Declaration of Independence the British Government had to seek elsewhere for a dumping-ground for its undesirables. Thus in 1787 a new penal settlement was founded at Botany Bay, in New South Wales. Though the system worked fairly well, it met with no more favour from the Australian than from the American colonists, and in 1840 the settlement was transferred to Tasmania. By the Penal Servitude

Acts of 1853 and 1857 transportation was practically abolished, and it soon ceased entirely.

In Russia, under the Tsars, there was much transportation of prisoners to Siberia, and the system is still practised in France and other countries. Transportation differs from banishment. The latter merely sends the offender out of the country, allowing him to go where he likes. Transportation sends him to a definite place for a definite period under supervision.



TRANSVAAL. The north-eastern province of the Union of South Africa, bounded on the north by the Limpopo River, and on the south by the Vaal. Area, 110,450 sq. miles; pop. (1921), 2,087,772 (543,673 white; white pop. in 1931, 695,963).

Physiography. The country is in general a plateau of 4000 feet mean elevation. The High Veld, between the Vaal and the Magalies Mountains, has a height of 5000-6000 feet; the Middle Veld has a height of 4000-5000 feet. The Low Veld is low, and is the most hot, humid, and unhealthy region. The plateau is crossed by a number of mountain ranges, among which the chief are the Magaliesberg, the Witwatersrand, the Drakensberg (Mauch Berg, 8725 feet), and Zoutpansberg, the last two in the east and north-east. Rivers are mostly tributaries of the Vaal or Limpopo, but a few flow direct to the Indian Ocean (e.g. the Crocodile and the Komati, which unite and flow into Delagoa Bay, and the Pongola). The larger area drains to the Indian Ocean.

Climate. The extreme north of the Transvaal is within the tropical zone, but most of the country is extra-tropical, and the climate generally is modified by the elevation. The Low Veld is dominated by the tsetse fly, and is not therefore a white man's country, although its mineral wealth has done much to repay risks taken. Malaria is prevalent there also, but is milder at elevations over 3500 feet. Daily temperature ranges are very wide (from over 100° F. by day to below zero at night), but the High Veld possesses one of the finest climates in the world.

Towns. Pretoria is the provincial (and the Union) capital. Other towns are: Johannesburg, Benoni, Krugersdorp, Boksburg, Potchefstroom, Roodepoort, Germiston, Middelburg, and Springs.

Production. The High Veld is a treeless grassland suitable for cattle and sheep, but the winter months are dry and unfavourable. The

Middle Veld is more limited in extent, and produces cereals, tobaccos, and fruit. The Low Veld produces gold, coal (fields at Boksburg and Middelburg), and diamonds (near Pretoria). Lourenço Marques is the outlet for the Transvaal, although it is in Portuguese territory. Most trade, however, is with the United Kingdom. There are several general manufacturing industries. On the whole, maize and tobacco are the chief crops, but the Transvaal must be considered more as a stock-raising region. Transvaal has railway communication with the rest of the Union and with the South-West Territory.

History. The Transvaal first appears in history in 1836, when some of the Boers who had left Cape Colony at the time of "The Great Trek" (*see* BOERS) crossed the Vaal in order to escape from British rule. With native assistance they drove the invading Matabele across the Limpopo, and organised a republican form of government. In 1852 (Sand River Convention) Britain formerly recognised their independence, but it was not till 1860 that the four Republics of Potchefstroom, Lydenburg, Utrecht, and Zoutpansberg were welded, as Transvaal, into a single republic. Three years later Pretoria became the capital.

The Republic had to face many difficulties, financial and other, and Sir Theophilus Shepstone, a British Commissioner with authority from the Imperial Government, thought that in 1877 its position justified annexation, and this was accordingly declared. The Executive and the President formally protested, and it soon became clear that a large majority of the inhabitants were opposed to annexation. Had the promise of legislative autonomy, however, been carried out without delay, all might have been well, but the Boers were led by repeated refusals to take up arms, and on 13th Dec., 1880, they declared their independence. For the later history, *see* SOUTH AFRICA, UNION OF.

Social Conditions. The population is naturally very mixed. In religion the Dutch Churches have an overwhelming majority among whites, Anglicans, Jews, Methodists, Presbyterians, and Roman Catholics following in order. Among non-whites the vast majority are non-Christian; the Christians are mostly Lutherans and Methodists, with Anglican and Dutch Churches far behind. There are thirty-two school districts, Government primary and secondary schools being free. The University of the Witwatersrand was established at Johannesburg in 1921. The native tongue of the scholar is taught up to the fourth standard, after which training is generally bilingual (i.e. English and Cape-Dutch).

Government. There is an Administrator, who is assisted by a Provincial Council of 49 members, and 49 members are sent to the Union Assembly.

TRANSYLVANIA. A province of Greater Rumania, officially called Ardeal, formerly one of the most prosperous parts of Hungary.

Production. Transylvania is mountainous, and 38 per cent of the area is wooded (chiefly beech). Sheep-rearing is probably the most important industry; apiculture is highly developed; and cattle-raising is progressive, including buffaloes bred for work and milk. Horse-breeding is important, and the export of horses is large. Maize is the chief grain crop; wheat and rye (small yields), oats, barley, and beet-root are others.

Communications. The Transylvanian trunk line is the Budapest-Predeal railway (with branches), which is joined at Tövis by another line from Budapest, entering Transylvania near Zám and following the Maros Valley.

Towns. Oradia Mare, Cluj, Arad, Sighetul Marmatiei, Brasov, Sibiu, Turda, and Bistrita.

Area, etc. Transylvania is divided into twenty-four districts for local government, and sends 45 Senators and 112 Deputies to the Rumanian Constituent Assembly. Area, 22,312 sq. miles; pop. 2,678,367. *See* RUMANIA (with map) for detailed physiography, etc.

History. The history of Transylvania may be epitomised as "the rise of the Vlachs." From the dawn of history there have been four contending nationalities within the region, and of these the Saxons, Magyars, and Szekels (Magyar-speaking) formed the "ruling-nations," who battled among themselves for hegemony, but were ever united to keep the fourth nation, the Vlach (Rumanian), in a state of serfdom.

After 1690 Transylvania fell more and more under Habsburg influence, and in 1765 was declared by Maria Theresa an Austrian Crownland, a policy of Germanisation being inaugurated. However, the *Ausgleich* or compromise between the Magyars and the Habsburg dynasty incorporated Transylvania in Hungary (1867), with full and equal political rights to all nationalties. Thus, nominally, were the Vlachs emancipated, but the rising spirit of

Rumanian nationalism began to inspire their kindred nationals of Rumania *irridenta*, and with the extinction of the Habsburg dynasty during the European War came definitive Vlach emancipation, union with Rumania being proclaimed at Alba Iulia in Dec., 1918. Saxon and Magyar minorities are guaranteed absolute political freedom.

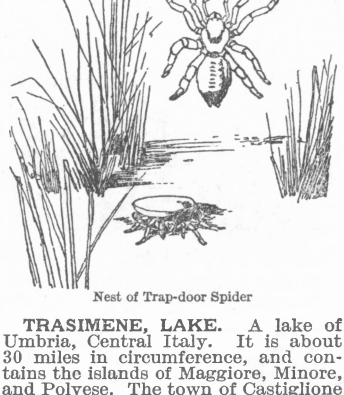
TRAP. A term rather loosely and vaguely applied by the earlier geologists to some or all of the multifarious igneous rocks that belong to the palæozoic and mesozoic eras, as distinct from granite on the one hand, and the recent volcanic rocks on the other. Trap-rocks of basaltic nature often assume a terraced appearance on weathering, whence their name from *trappa*, the Swedish for a stair. *Basalt* (q.v.) is the commonest of the trap-rocks. The hill-scenery of trappean districts is often picturesque, as in the north of Skye.

TRAPA. A genus of plants, order Onagraceæ, consisting of several species, floating in water, and having long jointed root-stocks, with hair-like roots. They yield edible seeds. *T. natans* of Central and Southern Europe has received the name of water-caltrops from its four-horned fruits. These, which are called Jesuits'-nuts in Italy, and water-chestnuts in France, are ground into flour and made into bread in the south of Europe. *T. bispinōsa* yields the Singhara-nuts of Northern India.

TRA'PANI. The westernmost province of Sicily. Area, 968 sq. miles; pop. (1931), 374,520. Trapani is the capital.

TRAPANI (ancient **Drepănon** or **Drepănum**). A seaport-town in Sicily, capital of the province of Trapani, on a peninsula shaped like a sickle, and hence its ancient name, from the Gr. *drepanon*, a sickle. It is on the Palermo-Marsala-Trapani coastal line, and has a cathedral of no great merit, lyceum, nautical school, etc. There is a trade in macaroni, wines, olive-oil, etc., and the fisheries are extensive. Pop. (commune) (1931), 60,001.

TRAP-DOOR SPIDER. A name given to certain spiders that have the habit of constructing tubular dwellings in the ground, sometimes a foot or more in depth and an inch or so in diameter, closed by a sort of hinged door. They belong to several genera, and are found in Southern Europe, Western North America, and elsewhere. The dwelling is lined with the silky substance spun by the insect, and the hinge of the door is formed of the same, the door itself being constructed sometimes of earthy particles connected by threads, sometimes of leaves, etc. Some species construct nests that have a main tube and one or more branches, the latter having a door where they join the main tube.



Nest of Trap-door Spider

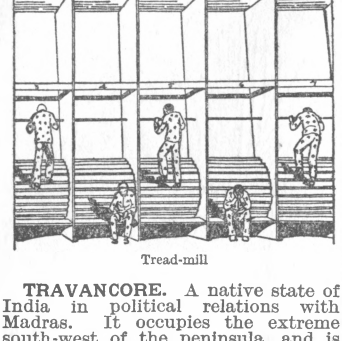
TRASIMENE, LAKE. A lake of Umbria, Central Italy. It is about 30 miles in circumference, and contains the islands of Maggiore, Minore, and Polvese. The town of Castiglione del Lago stands on a promontory on the western side. Trasimene is the *Trasimenus Lacus* of ancient times, and is especially famous on account of the great victory (217 B.C.) obtained there by Hannibal and the Carthaginians over the Roman consul C. Flaminius. This was one of the greatest defeats sustained by the Roman arms during the whole course of their history.

TRAS-OS-MONTES. An inland province of North-Eastern Portugal, draining to the basin of the Douro, which bounds it south and west, and traversed by the valleys of tributary streams, chiefly Sabor, Tuella, and Tamega. There are two districts, Bragança and Vila Real, with towns of same names. Area, 4163 sq. miles; pop. (1930), 435,138.

TRASS. A volcanic product, consisting of trachytic ashes and scoriæ thrown out from the ancient Eifel volcanoes, on the Rhine, near Coblenz. It is similar to the *pozzolana* of the Neapolitans, and is used for the manufacture of cement. The same name is given to a coarse sort of plaster or mortar made from other clayey materials, used to line cisterns and other reservoirs of water.

TRAUN, LAKE OF. A lake of Upper Austria, in the Salzkammergut. The River Traun passes through the lake and enters the Danube.

TRAUTENAU (now **TRUTNOV**). A town of Bohemia, Czechoslovakia, in the valley of the Riesengebirge. It is the Bohemian flax-spinning centre. Pop. 16,143.



Tread-mill

TRAVANCORE. A native state of India in political relations with Madras. It occupies the extreme south-west of the peninsula, and is described as "the most beautiful and fertile area of Southern India;" area, 7625 sq. miles. There are two railway systems. Rice is the chief crop; others are: pepper, arecanuts, cocoa, coffee, tea, cardamoms, tapioca, jack-fruit, tobacco, and oil plants. The ruler has the title of Maháraja, and the ruling family is Hindu, sovereignty passing in the female line. Trivandrum is the state capital. Pop. 5,095,973 (nearly 70 per cent Hindu, Christians second, and Mahommedans a bad third). Over 60 per cent of the people are dependent on agriculture.

TRAV'ERTINE. A white limestone deposited from the water of springs holding carbonate of lime in solution. Travertine is abundant in different parts of Italy, and a large proportion of the edifices of ancient and modern Rome are built of this stone. It tends to fill up valleys in the limestone lands east of the Adriatic.

TRAV'ESTY. A burlesque treatment or setting of a subject which had been originally handled in a serious or lofty manner. The term should never be confounded with *parody*, in which, strictly speaking, the subject-matter and characters are changed, and the language and style of the original humorously imitated; whereas in *travesty* the characters and the subject-matter remain substantially the same, the language becoming grotesque, frivolous, and absurd.

TRAVNIK. A town of Yugoslavia, in Bosnia, on the Lasva. It is mainly Mahommedan, and from 1700 to 1852 was the seat of the Turkish viziers of Bosnia. Pop. 6700.

TREAD-MILL. An instrument of punishment introduced into the prisons of Great Britain in 1820, but abolished early in the present century. It consisted of a large wheel, about 20 or 25 feet wide, with steps on its external surface, upon which criminals were placed. Their weight set the wheel in motion, and they maintained themselves in an upright posture by means of a horizontal bar fixed above them, of which they kept hold. The power thus obtained was sometimes applied to useful purposes.

TREASON, HIGH. Treason (Lat. *traditio*, surrender, delivery, from *tradere*, to deliver, betray), the *crimen læsæ majestatis* of the Roman law, is that crime which is directly committed against the supreme authority of the State, and is considered to be the greatest crime that can be committed. Formerly in England certain offences against private superiors were ranked as *petit* or *petty treason*, e.g. the killing of a master by his servants; and it was in opposition to such offences that treason against the sovereign was called high treason; but by 9 Geo. IV., cap. xxxi., S. 2, high treason was made the only treason. In a monarchy it is considered to be the betraying or the forfeiting of allegiance to the monarch; but in a republic it has reference to the Government or the whole community.

The present law of treason in the United Kingdom rests substantially upon the statute of the twenty-fifth year of Edward III., which comprehends the following descriptions, namely: (1) compassing or imagining the king's death; (2) violation of the king's companion (meaning the queen), his eldest daughter, unmarried, or the wife of the eldest son and heir; (3) levying war against the king in his realm; (4) adhering to his enemies in his realm, and giving them aid and comfort in the realm or elsewhere; (5) counterfeiting the Great or Privy Seal; and (6) slaying the Chancellor, Treasurer, etc. The third of the offences detailed in this statute is now treason-felony, and has a milder punishment than treason annexed to it. Clause 5 is now repealed.

The English law condemns the person convicted of treason to be drawn in a hurdle to the place of execution, there to be hanged, and then beheaded and quartered; and a conviction was followed by for-

feiture of land and goods, and attainder of blood; but this is now restricted to hanging, forfeiture and attainder being abolished by 33 and 34 Vict. xxiii. The concealment of treason is called misprision of treason. In the United States a citizen commits treason if he levies war against his country, or adheres to its enemies.

TREASON-FELONY. A term commonly used to designate those offences which are pronounced felony by 11 and 12 Vict. cap. xii. (1848), namely, the compassing, imagining, inventing, devising, or intending, first, to deprive the sovereign of any of the royal powers or prerogatives; or, second, to levy war within the realm in order to compel him forcibly to change his measures; or to intimidate either House of Parliament; or to excite an invasion in any of His Majesty's dominions. Treason-felony is punishable with penal servitude for life or for a term not less than seven years, or with imprisonment for a term not exceeding two years with or without hard labour.

TREASURER, LORD HIGH. Formerly the title given in England to the third great officer of State. First appointed by William I., the Lord High Treasurer was entrusted with the management of the king's exchequer. In 1612 the duties of the office were for the first time distributed among commissioners, and from the accession of George I. (1714) this has been the regular practice.

TREASURE TROVE. Coin, gold, silver-plate, or bullion found hidden in the earth or in any private place, the owner of which is not known. In Britain such treasure belongs to the Crown; but if the owner is known, or is ascertained after the treasure is found, the owner and not the Crown is entitled to it. It is, however, the practice of the Crown to pay the finder the full value of the property on its being delivered up. On the other hand, should the finder conceal or appropriate it he is guilty of an indictable offence punishable by fine and imprisonment. Coroners are empowered to inquire into cases of treasure trove.

TREASURY. The State department which has charge of the national finance, supervises the expenditure of the other departments, and prepares the annual Budget of national income and expenditure. The political head of the Treasury is the Chancellor of the Exchequer, with whom is associated the Financial Secretary to the Treasury. Nominally the Treasury is governed by a Board of Lords Commissioners, but the Board never meets. The office of First Lord of the Treasury is a sinecure, usually held by the Leader of the House of Commons, or the Prime Minister. The Patronage Secretary of the Treasury is the chief whip of the party in power in the House of Commons; and the Junior Lords of the Treasury are the junior whips.

The permanent staff of the Treasury is recruited from those who take the highest honours in the Civil Service Examination, and some of the ablest public officials are always to be found in that department. The business of financing the European War put an enormous strain upon this branch of the public service, from which it emerged with an enhanced reputation in financial circles at home and abroad. Among the new functions of the Treasury, necessitated by the exigencies of war, are the issue of currency notes and a much closer supervision of the operations of the Bank of England than has been customary hitherto.

TREATY PORT. Name used for certain seaports in China and Manchuria. They are those which are open to European trade by treaty. This was first done in 1842 after a war between Britain and China.

TREBBIA. A river of North Italy, which rises in the Apennines, and flows into the Po near Piacenza after a course of 58 miles. Here Hannibal defeated the Romans in 218 B.C.

TREBIZOND' (ancient **Trapezus**). A seaport-city of Turkey in Asia Minor, on the Black Sea. It occupies a plateau sloping to the sea, and bounded on either side by steep-walled valleys. Trebizond has always been an important place because of its position as an outlet for the European trade of Persia and Central Asia, but its position was assailed by the Transcausasian Railway (Batum-Baku), which assisted partially in diverting this trade to Russian hands. The roadstead is small and unsafe, and Platana (7 miles west) is more favoured in winter. North-Eastern Asia Minor depends on Trebizond for an outlet to the sea.

The city has a dockyard, tannery, dye-house, and wool-, silk-, and linen-factories. There is a Euxine fishery. Sheep, hides and skins, tobacco, and hazel-nuts are exported in normal times, mainly to European Turkey, France, Central Europe, and Russian states. Cottons, flour and meal, grain, cloth, and sugar are received from Great Britain, Turkey, France, and Central Europe. Persian goods in transit are usually carpets, silk, and dried fruits. Caravans leave

for Erzerum, Tabriz, and Syria. Pop. 24,587.

History. *Trapezus* originated in a colony founded on the coast of Pontus by the Sinopians, and derived its name from its location, although Trapezus in Arcadia pretended to be the mother-city. It flourished in the time of Xenophon, but did not achieve actual greatness until the Roman period, when it was made by Hadrian capital of Pontus Cappadocicus. After a period of over two centuries as capital of an independent principality founded by Alexius Comnenus, during which it survived the fall of Constantinople, it eventually fell to the Turks under Muhammad II. (1460), and since that time it has been a Turkish city, excepting a short period of Armenian domination subsequent to the Treaty of Sèvres (1920).

TREDE'GAR. An urban district and market town of Monmouthshire, England, on the Sirhowy. There are steelworks and ironworks, and coal is worked in the vicinity. Pop. (1931), 23,195.

TREE, Sir Herbert Beerbohm. British actor-manager; born 1853, died 1917. The son of a London merchant, Tree was a half-brother of Max Beerbohm, a noted caricaturist and dramatic critic, and made his début in London (1878), scoring a great success (1884) as the curate in *The Private Secretary*. In 1887 he began his first venture in management, and was eminently successful in melodrama, comedy, romance, and tragedy alike. His greatest successes, however, are considered to be his Shakespearean portrayals. In 1909 he was knighted. After the death of Sir Henry Irving, Tree was acknowledged as the head of the profession; and *Macbeth* (1911), *Othello* (1912), *Joseph and his Brethren* (1913), and *Pygmalion* (1914) showed him at his best. During the European War he was an active propagandist, especially in the United States.—Cf. Max Beerbohm, *Herbert Beerbohm Tree: some Memories of him.*

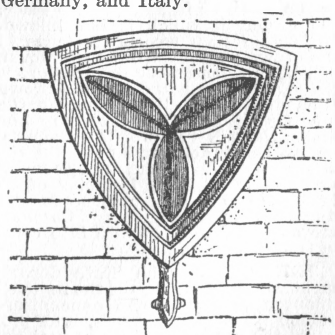
TREE. A perennial plant having a woody trunk from which spring branches having a structure similar to the trunk. Trees are thus distinguished from shrubs, which have perennial stems but have no trunk properly so called; and from herbs, whose stems live only a single year. It is difficult, however, to fix the exact limit between trees and shrubs.

Trees are both monocotyledonous and dicotyledonous, by far the greater number both of individuals and of varieties belonging to the latter class. Those of which the whole foliage falls off periodically, leaving them bare in winter, are called *deciduous*; those of which the foliage falls only partially, a fresh crop of leaves being always supplied before the mature leaves are exhausted, are called *evergreen*. Trees are the longest lived organisms of the vegetable kingdom, and attain a great and indefinite age, far exceeding that of animals. *See* BOTANY; SYLVICULTURE; TIMBER.

TREE-CRAB. A crab of the genus Birgus, included among the land-crabs. It breaks open the shell of the coco-nut, etc., by repeated blows of its great claws, in order to feed upon the soft pulp of the nut. One of the claws is narrow and used for perforating the soft spot in the shell. Tree-crabs can live for long periods out of water, but deposit their eggs in the sea.

TREE-FERNS. The name given to several species of ferns which attain to the size of trees, as the *Alsophila vestita*, *Cibotium Billardieri*, etc. They are found in tropical countries. A handsome species, *Cyathea medullāris*, contains in its trunk a mucilaginous pulp comparable to sago, which is used extensively for food in Polynesia and New Zealand.

TREE-FROG. A name of frogs differing from proper frogs in the extremities of their toes, each of which is expanded into a rounded adhesive disc, that enables the animals to adhere to the surface of bodies and to climb trees, where they remain during the summer feeding upon insects. *Hyla arborea*, the only European species, is common in France, Germany, and Italy.



Trefoil in Architecture

TREFOIL. A distinctive title applied to plants of various kinds on account of a peculiarity of the form of the leaf, which consists of three leaflets; examples, buck-bean,

clover, and medick. The same term is also applied to an ornamental foliation in Gothic architecture, used in the heads of windowlights, tracery, panelling, etc.

TREFOREST. District of Glamorganshire. It stands on the South Wales coal-field, 12 miles from Cardiff and 164 miles from London by the G.W. Railway. Pop. 12,365.

TREGARON. Town of Cardiganshire. It is 11 miles from Lampeter and 37 miles from Carmarthen, on the G. W. Railway. Pop. (1931), 1497.

TREHARRIS. Urban district of Glamorganshire. It is 14 miles north of Cardiff and 165 miles from London, on the G.W. Railway. It is a coal-mining centre. Pop. 8787.

TREITSCHKE, Heinrich Gotthard von. German historian and political writer, born 1834, died 1896. The son of a Saxon officer, he was educated at Leipzig and Bonn. Strong liberal opinions, later outgrown and changed to an extravagant devotion to the Hohenzollern line, at first debarred him from a professorship; but he subsequently held chairs at Freiburg (1863), Kiel (1866), Heidelberg (1867), and Berlin (1874). He was also prominent in journalism. In 1871 he entered the Reichstag. To an enthusiasm for German colonial expansion Treitschke added a bitter enmity towards Britain and her policy. His outstanding work is the *Deutsche Geschichte im 19. Jahrhundert*, a powerful though ill-constructed work which brings German history down to the year 1848. There is an English translation.

TRELOAR, Sir William Purdie. English philanthropist. He was born in London, 13th Jan., 1843, and educated at King's College School. He embarked upon a business career, at the same time taking an active interest in public affairs. In 1880 he became a member of the city corporation, was sheriff in 1899-1900, and Lord Mayor, 1906-7. He founded the Lord Mayor **Treloar's Cripples' Hospital** and College at Alton and Hayling Island, Hants. He was knighted in 1900, created a baronet in 1907, and died 6th Sept., 1923.

TREMATO'DA. A division of the phylum Platyhelmia or flat-worms, and represented by such forms as the flukes or Distoma (*see* DISTOMUM) and their allies. They are parasitic worms, usually of a flattened or rounded form, and are furnished with one or more suctorial pores, like minute cupping-glasses, for adhesion to the tissues of their hosts.

TREMELLINEÆ. A primitive family of basidiomycetous Fungi, distinguished by their basidia being vertically four-chambered. Tremella is the type-genus. The pale-yellow shapeless gelatinous fruit-bodies of *T. lutescens* are not uncommon on dead wood.

TREM'OLITE. A mineral, one of the amphiboles. It is a silicate of calcium and magnesium, is white or colourless, and usually occurs in long, prismatic crystals.

TRENCH, Richard Chenevix. British divine, poet, and philologist, born in 1807, died in 1886. Educated at Trinity College, Cambridge, he was curate to Archdeacon Wilberforce and rector of Itchenstoke, and became professor of theology at King's College, London, in 1846. Dean of Westminster from 1856 to 1863, he was consecrated Archbishop of Dublin, 1st Jan., 1864. Ill health forced him to resign the archbishopric in Nov., 1884. His works include: *Notes on the Parables* (1841), *Notes on the Miracles* (1846), *On the Study of Words* (1851), *Proverbs and their Lessons* (1853), *Synonyms of the New Testament* (1854), *English Past and Present* (1855), *On Plutarch* (1874), and *Lectures on Mediæval Church History* (1878).

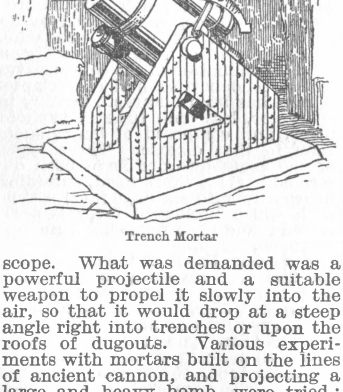
TRENCH FEVER. An infection communicated through the instrumentality of lice, and marked by an abrupt onset of fever, headache, muscular pain of varying severity, a mild inflammation of the conjunctiva, and a tendency to periodic relapse. A rash has been observed, fleeting in character, less pink than in typhoid fever, and composed of larger spots than in that disease. Three types of the acute disorder have been described: (1) a short form, subsiding in from four to six days; (2) a type with which prolonged fever is associated; and (3) a relapsing form.

Appearing among the troops on the Western Front at the end of 1914 the first type gave way to the second and third in the later years of the European War. During and after 1917, type (2) was more prominently noticed than type (1); but in 1918 about 70 per cent of cases were of the relapsing type. It has been computed that nearly one-quarter of the sick wastage in France during the war was due to trench fever. About 8 per cent of the cases became chronic. A strong tendency to involvement of the heart was observed in these and also in some acute cases. Neurasthenia in predisposed persons is also favoured by the infection.

In 1919 regulations issued by the Local Government Board (afterwards

the Ministry of Health) laid upon medical officers of health the responsibility of securing as far as possible that the disease should not become endemic in Great Britain. Latency for so long as four years after infection has been recorded. In such cases each successive attack seems to be less severe. Apart from symptomatic treatment of the individual, disinfestation and disinfection are essential for prophylactic reasons. It is not certain whether any fever described before 1914 was identical with trench fever.

TRENCH MORTARS. During the European War the necessity for cover of some kind soon made life underground compulsory, and it immediately became evident that, if the war was to go on, some new form of weapon must be devised to supplement the rifle and the field-gun, some weapon which could be counted on to carry death and destruction into a deep and narrow trench from short range. Bombs and grenades had already appeared and catapults followed, but these had a very limited



Trench Mortar

scope. What was demanded was a powerful projectile and a suitable weapon to propel it slowly into the air, so that it would drop at a steep angle right into trenches or upon the roofs of dugouts. Various experiments with mortars built on the lines of ancient cannon, and projecting a large and heavy bomb, were tried; and the Germans used a large round bomb attached to a stick. The stick fitted into the barrel of a short mortar having the bomb sitting on the muzzle; a small propellant charge only was used, and the bomb sailed slowly through the air, and exploded with a terrific effect when it struck the ground; the rate of fire of this variety was slow.

Then in 1915 Mr. Stokes, of the Ransome Agricultural Machinery Company, began to experiment with a trench mortar, since known as the Stokes gun. This perfected mortar with its special projectile has proved to be the best-known weapon of its kind, and all its types are of great use in open and trench warfare, whether in attack or defence. The inventor's object was to produce a mortar having the following essential qualities: (1) light, portable, easily set up; (2) accurately laid by a simple angle; (3) a fair range; (4) useful behind cover and in the open; (5) having the shell and propellant as nearly as possible in one unit; (6) capable of giving a rapid rate of fire. He was successful in meeting all of these requirements.

The Gun. The gun consists of a steel tube of various diameters, according as it is a light, medium, or heavy mortar. The bottom end is reinforced to stand the explosion of the charge, and has a steel spike projecting up from it; this acts as a striker. A steel plate is sunk or laid on the ground, against which the end of the gun is placed to prevent it drilling into the ground on discharge. The front end is supported by a tripod, which can be adjusted to almost any angle up to about 85°. The shell is most ingenious, consisting of a cast-iron pointed cylinder with a smaller hollow cylinder projecting from the base to take the propellant. The propellant consists of nothing more or less than a form of sporting cartridge inserted in the bottom cylinder; it can be augmented to give a longer range by putting rings of cordite round the original charge to make it more powerful.

The gun is laid to the proper angle, and is fired by the gunner dropping the shells down the mouth base first; this can be done, if necessary, as fast as they are passed to him. The cap on the cartridge strikes the steel spike on the bottom of the tube, and is thus fired by its own weight. With a good team great rates of fire can be obtained, sometimes up to 30 rounds a minute, but owing to the weight of ammunition and difficulty of transport this rate is not often used. The shell is charged with different kinds of explosive according to what is required, ammonal, amatol, and sometimes thermite for incendiary purposes, and also for creating smoke.

TRENCHARD, Hugh Montague, First Baron. Born 3rd Feb., 1873, he entered the army in 1893 and served with distinction in the Boer War (1899-1902), as well as during the

Great War. He was Colonel in 1915, Major-General in 1916, Air Chief Marshal, 1922, and Marshal of the Air, 1927. He succeeded Lord Byng as Commissioner of the Metropolitan Police Force, 2nd Nov., 1931. He was created baronet in 1919, and baron in 1930, and was awarded a G.C.B. in 1924. In 1933 a Bill for the reform of the police organisation ("Trenchard's Bill"), based on a report by Lord Trenchard, was introduced in Parliament.

TRENGGANU. One of the unfederated Malay States, situated on the east of the peninsula between Kelantan and Pahang; area, 5500 sq. miles; pop. (1931), 179,664. It is well watered and fertile, and exports tin, wolfram, rubber, copra, and pepper. The capital is Kuala Trengganu. Trengganu came under British protection in 1909. *See* MALAYA.

TRENT. A river of England which rises in Staffordshire, flows through the counties of Stafford, Derby, Nottingham, and Lincoln, and falls into the Humber after a course of 170 miles. A navigation scheme will make the Trent navigable for barges of 120 tons between Nottingham and the sea (96 miles), where special facilities exist for barge-loading at Hull.

TRENT, COUNCIL OF. An œcumenical council of the Roman Catholic Church, convened to settle various controversies that were agitating the Church during the Reformation period, and for the reform of abuses. It met at Trent in 1545 during the pontificate of Paul III., but the wars in Germany caused its transference to Bologna in 1546, when it dispersed. Pope Julius III. again convoked it at Trent in 1551, but it dispersed a year later on the approach of the Lutherans. Eight years afterwards it was again called together by Pius IV., and it finished its labours in 1563. This council definitely settled the doctrines of the Roman Catholic Church. Its decrees are embodied in what is known as the Creed of Pius IV.

TRENTHAM. Village of Staffordshire. It is 3 miles from Stoke-on-Trent, on the L.M.S. Railway. Pop. 3141. **Trentham Hall**, the seat of the Duke of Sutherland, was pulled down in 1911 and the grounds made into a public Park. One of the finest houses in England, it was built about 1840.

TRENTINO. A northern frontier province of Italy, embracing the departments of Bolzano and Trento. Including the Alto Adige, it is largely mountainous, and has exits by the Brenner Pass, Reschen Pass, and Toblach Pass. The northern end of Lake Garda is within the province, which belongs almost entirely to the basin of the Adige, along the valley of which, with its tributaries, the population is mainly concentrated, although there are few inhabitants above 4300 feet altitude. All the rivers are torrential, even the Adige, which is under 100 yards wide in the Trentino, and also the second largest river, the Brenta. The Sarca rises on the western frontier and falls into Lake Garda. Climatically the province varies between the warm shores of Garda and the frozen, glacial valleys of the mighty snow-capped mountains.

Area, etc. The total area is about 5361 sq. miles and the pop. (1931), 660,137 (Bolzano, area 2831 sq. miles, pop. 269,610; Trento, area 2535 sq. miles, pop. 390,527). Towns include those at the junction of transverse valleys with the longitudinal valleys; such are: Bressanone (or Brixen), at the confluence of Rienz (which flows along the Val Pusteria) and Isargo; Merano (19,000), at the confluence of Passiero and Adige; Bolzano, capital of Alto Adige, at confluence of Tolferbach and Isargo, above Isargo-Adige confluence; Trento, at mouth of Fersina, the provincial capital; Roverto (14,000), at Leno-Adige confluence; Riva (1000), on the shores of Lake Garda; and Levico (9000). The chief mineral springs and spas are Merano, Riva, Afco, and Levico.

Communications. The famous Brenner railway line from Innsbruck (Tirol) crosses the frontier at Brennero, and runs down the Adige Valley through Bolzano, Trendo, Roverto, and Mori to Verona (in Venetia).

People. The Trentino and Alto Adige are geographically one but ethnologically divided. In the Trentino Italians predominated at the Austrian census of 1910, but only in the Ampezzo district of Alto Adige did they show a majority over the German element. As the Treaty of St. Germain-en-Laye was drawn up with an eye to ethnologic justice, the frontier of Italy now includes as few other nationals as is humanly possible and it is therefore considered as being satisfactory. Pellagra is endemic. Of the people, only about 12 per cent are urban, and the vast majority are small farmers.

Production. Silk is produced, and the mulberry tree is widely cultivated. The Trentino supplied 90 per cent of Austrian cocoons before the European War. Cattle-raising is progressive; fruit is raised on the shores of Lake Garda (oranges, lemons, and olives) and in the sheltered valleys

elsewhere (apples, pears, plums, quinces, etc.). The vineyards of the Adige Valley, the Val di Non, and Val Sugana are noted; vines are planted up to 2000 feet, and the mulberry trees form a fringe above them. About 87 per cent of Trentino is productive. Forests are thickest around Riva, and rivers and tarns are rich in fish. Minerals are practically unexploited, but reputed rich, and there is an abundance of medicinal springs, chiefly iron. Trentino's greatest asset is probably the enormous amount of potential hydro-electric power that flows daily through her afforested valleys. (*See* TIROL.)

Modern History. The region passed to Austria after the downfall of Napoleon and (1814) became a part of Tirol, which it remained until the European War, when by a secret treaty, in which Britain and France guaranteed the Trentino to Italy (26th April, 1915), that country broke her connection with the Triple Alliance. The region passed to Italy by the Treaty of St. Germain-en-Laye (1919). In 1926 there was trouble with Germany over Italian treatment of the German inhabitants of the Alto Adige.—Cf. *Peace Handbook No. 33* (in vol. vi.) (H.M. Stationery Office).

TRENTO (Ger. *Trient*, Lat. *Tridentum*). A town of Italy, on the Adige, the capital of Trentino. Pop. (commune) (1931), 56,760. For department of Trento *see* TRENTINO.

TRENTON. A city of New Jersey, United States, the state capital and county seat of Mercer county, on Delaware River; served by the Pennsylvania and the Philadelphia & Reading Railways, and by Delaware-Raritan Canal. Trenton is the greatest producer of pottery in the United States, and has developed into a great industrial metropolis through the organisation of its transport systems by rail and water—it is at the head of navigation on the Delaware River—and through its proximity to the great Pennsylvania coal-fields. Settled in 1676, it became state capital in 1790, and was chartered as a city in 1792. Pop. (1930), 123,356 (fourth largest city in New Jersey).

TREPANG. The sea-slug, a marine animal of the genera Holothuria and Stichopus, belonging to the phylum Echinodermata class Holothuroidea, popularly known as "sea-cucumbers," or bêche-de-mer. It is found chiefly about coral reefs in the Eastern seas, and is a rather repulsive-looking animal, somewhat resembling the land-slug in shape, and varying in length from 6 to 24 inches. Sun-dried trepangs are in special request in China for making soups. The fishery is carried on in numerous localities in the Indian Ocean, the Malay Archipelago, and on the coasts of tropical Australia.

TREPANNING. In surgery, the operation of cutting an opening into the skull by means of a *trepan*, or boring instrument, with which several holes are made in a circle, the intervening bone being then removed. *See* TREPHINING.

TREPHIN'ING. One of the several modern methods for gaining access to the brain or its membranes, to relieve the organ from pressure, arrest hæmorrhage, evacuate an abscess, or remove a tumour. The instrument used, the *trephine*, consists of a handle to which is fixed a small hollow steel cylinder, of about ½ to 1 inch diameter, having teeth cut on its lower edge.

TRESCO. *See* SCILLY ISLES.

TRESPASS. In law, a term applied generally to any offence against the person or property of another, but more especially applied to a peaceable but unlawful entry upon the property of another, the remedy for which in English law is by action of damages. Any injuries committed against land or buildings are in the most ordinary sense of the word trespasses, as entering another's house without permission, walking over the ground of another, or suffering any cattle to stray upon it, or any act or practice which damages the property, or interferes with the owner's or occupier's rights of possession.

A creditor or customer can be ordered away by a householder or shopkeeper, and even the civil courts have no power to give a right of entry to officers entrusted with the execution of legal processes, though such officers may maintain possession if once they gain entrance. Of course, there is no trespass when one enters upon the land or buildings of another in exercise of a right, or in the enjoyment of an easement. Trespassers in pursuit of game are liable in Britain to summary prosecution.

TREVEL'YAN, The Rt. Hon. Sir George Otto, Bart. British author and politician, the only son of Sir Charles E. Trevelyan, and nephew of Lord Macaulay, born in 1838. Educated at Harrow, he graduated at Trinity College, Cambridge, and entered the Indian civil service by competition. He was a member of Parliament from 1865 to 1897, and except for a short interval always followed Gladstone's

lead. He held the following official appointments: Lord of the Admiralty (1868-70), Secretary to Admiralty (1880-2), Chief Secretary for Ireland (1882-4), Chancellor of the Duchy of Lancaster (1884), and Secretary for Scotland (1886 and 1892-5). In 1911 he was created O.M. He is author of the *Life and Letters of Lord Macaulay*, *The Early History of Charles James Fox*, and *Interludes in Prose and Verse*, etc. He died in 1928.

His eldest son, the **Rt. Hon. Charles Philips Trevelyan**, was born in London, 28th Oct., 1870, and also educated at Harrow and Cambridge. He became Parliamentary Secretary to the Board of Education in 1908, but resigned in 1914, being opposed to the Government war policy. He re-entered Parliament in 1922 in the Labour interest, and was President of the Board of Education in 1924 and 1929-31.

George Macaulay Trevelyan, the third son of Sir George Otto, was born 16th Feb., 1876, and also educated at Harrow and Cambridge, where he has been Regius Professor of History since 1927. He has honorary degrees from Oxford, St. Andrews, Edinburgh, and Durham, and has written an appreciation of Meredith, three books on Garibaldi, a *Life of John Bright*, *England under the Stuarts*, *British History in the Nineteenth Century*, *A History of England*, *Blenheim*, and other books on historical subjects. He was awarded the Order of Merit in 1930.

TRÈVES (Lat. *Augusta Trevirorum*). A city of Rhenish Prussia, on the Moselle; a junction on the Cologne-Saarbruck line of the State Railways, whence branches run to Coblenz, Metz, Luxemburg, Hermeskeil, and Bullay. It is considered the oldest city in Germany, and has many Roman remains, including amphitheatre, Porta Nigra (Black Gate), Imperial palace, baths, etc. The Roman Catholic cathedral, finished in 1196, containing the Holy Coat (q.v.); the Basilica, begun by Constantine the Great; and the former archiepiscopal palace, later a military barracks, are interesting features. Trèves is of great commercial importance, manufacturing industrial machinery of all kinds, cloth, tobaccos, leathers, beers, furniture, etc., and there are wine and fruit markets. Pop. 53,250.

History. Originating as capital of the Treviri, a Belgic tribe conquered (56 B.C.) by Cæsar, Trèves ultimately became the administrative centre for Roman Gaul, Britain, and Spain, and was the residence of Constantine the Great between 305-306 and 331. Temporal power was gained by the Archbishop of Trèves in 898, and his successors seldom moved in their spiritual office without an eye to possible gain in temporal sovereignty. From 1315 Trèves ranked after Cologne and Mainz, respectively, in the electoral college. During the Thirty Years' War the Elector Philip favoured France, and the city suffered much from all the belligerents. The electorate-archbishopric became extinct with Clement-Wenceslaus (1768-1802), and in 1821 a bishopric suffragan to Cologne was erected, having nearly the same territorial dimensions as the old archbishopric.

TREVISO (ancient **Tarvisium**). A town of Italy, capital of the province of Treviso, on the Sile; the junction for Vicenza, Belluno, and Motta di Livenza, on the Venice-Udine Railway. The manufactures consist chiefly of silk and cotton goods, machinery, and cutlery. During the European War Treviso was a base of the Italian army (1915-8). Pop. (1931), 53,952.

TREV'ITHICK, Richard. British engineer and inventor, born in Cornwall 1771, died 1833. In 1797 he succeeded his father as a leading engineer in Cornish mining. Among his first inventions was an improved pump, which soon came into universal use in deep mining. He next perfected a high-pressure steam-engine, and began to experiment in the construction of locomotive engines. Passengers were first conveyed by steam by means of his road locomotive in 1801, and he soon after successfully worked a tramroad locomotive. His ideas were afterwards taken up and developed by Stephenson. He was the first to recognise the value of iron in shipbuilding, and the application of steam to agriculture. His request for recognition and reward for his numerous inventions was disregarded by Government.—Cf. S. Smiles, *Lives of the Engineers*.

TRIAL. The judicial examination of a cause. It may take place before a judge and a jury or (more frequently) before a judge alone.

Briefly, the procedure at a trail is as follows. Counsel for the party on whom rests the burden of proof (usually the plaintiff) leads in the proof. He opens with a speech setting forth the facts on which he relies and which he hopes to prove. He then calls his witnesses, who are in turn examined by him for the purpose of eliciting these facts; cross-examined by the opposing counsel with a view to breaking down their evidence, destroying their credibility,

or obtaining useful admissions; and re-examined by the former counsel on any fresh points brought out in the cross examination. The judge may also put questions to the witnesses. Counsel for the other party then opens his case and calls his witnesses, who are examined by him, cross-examined by his opponent, and, if necessary, re-examined in similar manner. He thereafter addresses the court on the evidence, and counsel for the leading party replies. The judge sums up. If there is a jury, he directs it on the law, and he may give a résumé of the whole evidence and express his opinion. The function of the jury is to find a verdict on the facts. The judge decides questions of law and gives judgment.

In Scotland the procedure is very similar, but there are no opening speeches, and counsel for the defender in the action or the issue has the last word before the summing-up of the judge.

TRIANON, TREATY OF. The treaty of peace between the Allies and Hungary signed in 1920 in the Grand Trianon at Versailles. By it certain areas on the Burgenland frontier were ceded to Austria, and the provisions of the St. Germain Treaty (q.v.) regarding the cession of Bosnia, Hercegovina, and Slavonia to Yugoslavia, and Transylvania to Rumania, were confirmed.

TRIAS, or TRIASSIC. The name of the geological system and period which open the Mesozoic group and era. The beds of this period are poorly represented in Britain, where they were deposited under continental and semi-arid conditions, and are often styled the New Red Sandstone. In Central Germany, a marine zone, the *Muschelkalk*, intervenes between the *Bunter* series and the *Keuper* beds above. But in the Eastern Alps there is a continuous marine sequence, with numerous ammonites, closing with the *Rhætic* series. The period is noteworthy for the rise of the reptiles, including dinosaurs, as the dominant forms of life.

TRIBE. A group of individuals linked together by cultural and linguistic bonds, occupying a certain territory and claiming a common ancestor. It is thus a political group presupposing an ethnical relationship. Next to the family, the tribe is the simplest social-political unit. An aggregate of families, or communities, under one chief, constitutes a tribe, whilst the coalescence of tribes, in the same area and under the same government, forms a state, or, if the tribes be related, a nation.

TRI'BUNE (*tribūnus*). In Roman antiquity, an officer or magistrate chosen by the people to protect them from the oppression of the patricians or nobles. These magistrates were at first two, but their number was increased to five and ultimately to ten. There were also military tribunes, officers of the army, each of whom commanded a division or legion, and also other officers called tribunes: as, *tribunes* of the treasury, of the horse, etc.

TRICERATOPS. A gigantic horned dinosaurian reptile, herbivorous, but heavily armoured with a collar-like

Triceratops

expansion at the back of the skull, set with formidable spikes. It occurs in the latest Cretaceous strata of North America.

TRICHINA (tri-kī'na). A minute nematoid worm, the larva of which was discovered in 1835 in the tissue of the voluntary muscles of man, giving rise to the disease known as *trichiniasis* (q.v.). The worm is common also to several other mammals, and especially to the pig and rat, and it is generally from the former that man receives the disease. When a portion of pork containing larvæ is taken into the stomach, the larvæ in a few days become developed into procreative adult worms, having in the meantime passed into the intestines. The male worm is about $\frac{1}{10}$th of an inch long, the female about a half more. The female produces embryos in extraordinary numbers, which gain entrance into the muscles by penetrating the mucous coat of the intestine and entering the capillaries, whence they are carried to their habitat by the circulation. In the muscles they become quiescent, are encased in a cyst covered with calcareous matter, and may give no more trouble.

TRICHINIASIS, TRICHINELLIASIS, or TRICHINOSIS. A disease caused by the parasitic worm *Trichinella spiralis* (*see* TRICHINA). Infection in man is due to eating pork

containing the encysted larva. The parasite passes the three stages of its life-history, as adult, embryo, and encysted larva, in the human body, and the symptoms of the disease occur roughly in three stages corresponding to these. The first stage is one of gastro-intestinal irritation, associated with severe pain, vomiting, and diarrhœa, and at times so severe as to resemble the onset of cholera. After about one week the second stage begins, and it is a period of general infection, with characteristic tender swollen muscles, causing such pain on movement that the patient lies motionless with limbs partially flexed. There is high remittent fever, with insomnia, delirium, and often marked difficulty in breathing, while bronchitis and congestion of the lungs are a common and dangerous complication. The third stage shows a gradual lessening of all the symptoms, due to the death of the adults and the encystment of the embryos. There is at this stage marked wasting, and the patient is much debilitated.

Treatment at first should be vigorously carried out in order to kill the parasite, but after the general infection has taken place this is useless, and only palliative measures to maintain the patient's strength are of any use. Preventive measures regarding the feeding of pigs and thorough cooking are the most effective means of avoiding the disease. It is most often found in Germany, North America, Holland, and Scandinavia, while it is rare in Great Britain and France.

TRICHINOP'OLY. An inland district and city of Madras, India. The district is generally an undulating plain traversed from west to east by the Cauvery, and served by the South Indian Railway (main line). Cereals, pulses, chillies, cotton, plantains, ground-nuts, betel-leaf, cocoanuts, hides, castor-oil, saltpetre, etc., are exported. The city is the district headquarters, and is a noted cigar-making centre as well as the metropolis of general trade. It is a great educational centre. Area (district), 4935 sq. miles; pop. 2,107,000; pop. (city, 1931), 142,843.

TRIDYMITE. A mineral formed, like quartz, of silica, but crystallising in small six-sided plates, and with a specific gravity of only 2·3. It occurs in many rhyolitic lavas. When powdered quartz is heated to 870° C., it passes into tridymite. *See* CRISTOBALITE.

TRIESTE (ancient **Tergeste**). A seaport of Istria, Italy, formerly an Austrian crown-land and the chief seaport of the Austrian Empire, on the Gulf of Trieste, an arm of the Adriatic; served by the railway from Venice, via Udine and Cormons.[1] Trieste is the natural outlet for Central Europe and for a large part of Southern Germany. It has been a shipbuilding centre from Roman times, and the modern yards employ upwards of 12,000 men.

The port comprises three divisions: (1) the Porto Vecchio, an improved port once used by the Romans; (2) the Porto Nuovo di St. Andrea, which owes its existence to the traffic brought by the Tauern Railway; and (3) the Porto Nuovo, an extension of the Porto Vecchio, completed in 1857 on the arrival of the Südbahn. It abuts the main (*Meridionale*) station. There is an arsenal; dry-docks, etc., also exist.

Trieste is an industrial city, with brewing, cement, coffee, jute, marble, linoleum, and other manufactures; there are rice-mills, oil-refineries, and ironworks (also at Servola). The enormous variety of commodities passing into and out of the city defies imagination; among exports are: coffee, rice and oil (mainly to the Balkans and the Levant), tobacco, rice starch, sugar, timber, cotton yarns, iron and hardware, paper, clothing and woollens, magnesite, glassware, and beer; and imports include: raw cotton, oil-seeds, jute, wool, tea, fish, nickel, boilers, ship fittings, coal, coffee, hides and skins, rice, copper, cereals in general, tobacco, and fruit.

History. Trieste was a Roman colony, and in the Middle Ages was capital of an independent republic which became Austrian in 1382. It was declared a free port in 1719, and soon attained great importance as the chief seaport of the Austrian Empire. In 1867 the whole district was formed into an Austrian crown-land. By the Treaty of London, 1915 (*see* EUROPEAN WAR), Trieste was promised to Italy (of the total population of 191,000 in 1910, 119,000 were Italian, 57,000 Slovene, and 12,000 German), and this was confirmed by the Treaty of St. Germain (1919). The area of Trieste

[1] Trieste is served by what was the Austrian Südbahn from Vienna, via Laibach and Sankt Peter (see *Styria*). There is a line from Trieste to Parenzo (95 miles), one to Opcina (a mountain railway, 4 miles long), and a "white elephant" ex Trieste, via Capodistria, Porto Rose, Buje, Grisignano, and the Quieto Valley to Parenzo. This last taps a region that is already better served by sea. The Tauern Railway (see *Salzburg*), running via Gorizia over the Karst (1000 feet altitude) to Opcina and Trieste, and the Suez Canal were vital factors which helped to raise the city from a mere hamlet to a first-class port. The Tauern line was opened in 1909. See *Systems, Railway*, paragraph 6, section (*h*).

district (including the former crown-land) is 475 sq. miles, and the pop. 325,940. The census communal population of Trieste in 1931 was 249,574. The republic of Czecho-slovakia, which has no coast-line, has been given certain rights regarding the use of Trieste port. Trieste has a higher institute for commercial education.

TRIGGER-FISHES (Balistes). A genus of teleostean fishes, so named from the peculiar structure of the dorsal fin, the first ray or spine of which can only be depressed by the movement of the second ray—the mechanism being thus like that of a gun-trigger.

TRIGONOMETRY. In the literal and original sense of the word, the science of the measurement of triangles. In order to construct a triangle, it is not necessary to know the values of all its "parts," i.e. its three sides and three angles. If the three sides, for example, are known, the triangle can be drawn, and the angles found by measurement. There must therefore be some analytical formula connecting the value of an angle with the values of the three sides. The investigation of formulæ of this type is one of the main objects of elementary trigonometry. It turns out that the relations sought do not give, in terms of the sides, the angles themselves, i.e. the numbers which represent the angles in degrees or radians, but certain functions of these numbers. Thus if A is an acute angle of the triangle ABC, and if D is the foot of the perpendicular from C to AB, we have, by *Euclid*, ii., 13, $AD/AC = (AC^2 + AB^2 - BC^2)/(2AB.AC)$, so that, when the sides are given, the ratio AD/AC is known; and, by the properties of similar triangles, this is a function of the angle A alone.

The trigonometrical functions thus introduced are found to have applications far transcending mere geometry, so that it has become the practice even in elementary teaching to define them for *all* values of the number on which they depend. We have first to show how this number, which may be positive or negative, can be represented graphically by an angle. Take rectangular axes X′OX, Y′OY, and with centre O and any radius r draw a circle cutting these axes at X, Y, X′, Y′. To represent a positive number θ, let a radius of the circle, starting from the position OX, revolve through an angle of θ radians (*see* DEGREE) counter-clockwise; if θ is negative, make the radius revolve through $(-\theta)$ radians clockwise. Let the co-ordinates of the point P, on the circle, at which the end of the moving radius arrives, be x, y. Then we take for definitions of the functions *cosine* and *sine*,

$$\text{cosine}\theta = x/r, \ \text{sine}\theta = y/r;$$

or, as they are usually written for brevity,

$$\cos\theta = x/r, \ \sin\theta = y/r.$$

The number r is always taken positive; x and y are positive or negative according to the position of P, x being positive when P is to the right of Y′OY, and y positive when P is above X′OX. Besides the *sine* and *cosine*, certain other functions are in common use. Their definitions are: $\tan\theta = \sin\theta/\cos\theta$, $\cot\theta = \cos\theta/\sin\theta$, $\sec\theta = 1/\cos\theta$, $\text{cosec}\theta = 1/\sin\theta$. Of these four functions the *tangent* is the most important; the *secant* and *cosecant* seldom occur. Many important properties of the functions follow at once from the definitions, e.g.:

$$\sin^2\theta + \cos^2\theta = 1; \ \sin(\tfrac{1}{2}\pi - \theta) = \cos\theta;$$
$$\sin(\pi - \theta) = \sin\theta;$$
$$\cos(\pi - \theta) = -\cos\theta; \ \sin(-\theta) = -\sin\theta;$$
$$\cos(-\theta) = \cos\theta;$$
$$\sin(2\pi + \theta) = \sin\theta; \ \cos(2\pi + \theta) = \cos\theta.$$

The last two equations show that the sine and cosine are *periodic* functions, their period being 2π. If the argument of the function is understood to be an angle, it is not necessary that the angle should be expressed in radians, and in geometrical applications it is usually expressed in degrees, so that we have such equations as $\cos(90° - A) = \sin A$, $\tan(180° + A) = \tan A$.

The relations between the sides and angles of a triangle ABC are easily found from a figure. If a, b, c are the lengths of the sides opposite the angles A, B, C respectively, we have $\cos A = (b^2 + c^2 - a^2)/(2bc)$, with two similar equations; when the sides are given, this determines A, with the help of a table of cosines. An equivalent form is $a^2 = b^2 + c^2 - 2bc \cos A$; this gives the third side when two sides and the included angle are known. Another important set of relations is: $\sin A/a = \sin B/b = \sin C/c$; when two angles and a side are given, these determine the remaining sides. By means of the above equations, any triangle can be *solved*, i.e. given a sufficient number of sides and angles, the rest can be found. In the process of solving triangles, formulæ suitable for working with logarithms are almost always used; the important case of two sides and the contained angle (say b, c, A) being given is solved with the help of the formula $\tan\frac{1}{2}(B - C) = \cot\frac{1}{2}A(b - c)/(b + c)$.

The development of the more analytical part of trigonometry starts with the *addition theorem*, $\cos(A + B)$

= cosA cosB − sinA sinB, which is easily proved by geometry for all values of A and B, and which leads to the similar formula sin(A + B) = sinA cosB + cosA sinB. If we denote the symbol $\sqrt{-1}$ by i, we deduce (cosA + i sinA)(cosB + i sinB) = cos(A + B) + i sin(A + B); and (cosA + i sinA)^n = cos$n$A + i sin$n$A, where n is any positive integer. From the last result, which is called *De moivre's Theorem*, the expansions of sin$x$ and cos$x$ in infinite series of ascending powers of x (*see* FUNCTION) are readily obtained.—BIBLIOGRAPHY: Elementary treatises by H. S. Carslaw, Bridgett and Hyslop, Hobson and Jessop, Levett and Davidson; for analytical trigonometry, E. W. Hobson, *Plane Trigonometry*; G. Chrystal, *Algebra*.

TRIGONOMETRY, SPHERICAL. The branch of mathematics which investigates the relations between the sides and angles of a spherical triangle. If three lines OA, OB, OC, not all in one plane, are cut by a sphere with centre O at A, B, C, then the planes OBC, OCA, OAB will cut the sphere in three great circles. The angles between the planes of the great circles are called the *angles* of the triangle. The angle A is therefore the angle between the planes OAB, OAC, and this is obviously the same as the angle between the tangents at A to the arcs AB and AC. By the *sides* of the triangle we mean the angles subtended at O by the arcs BC, CA, AB; these are usually referred to as the sides BC, CA, AB, and denoted by a, b, c; they are proportional to the lengths of the arcs.

The fundamental relation, giving an angle in terms of the sides, may be proved as follows. Let the tangents at A to the arcs AB, AC, meet OB, OC at E, F. Then cos$a$ = cosBOC = cosEOF = $(OE^2 + OF^2 - EF^2)/(2OE.OF)$ = $(OA^2 + AE^2 + OA^2 + AF^2 - EF^2)/(2OE.OF)$ = $(2OA^2 + 2AF.AE\ \cos FAE)/(2OE.OF)$ = (OA/OF)(OA/OE) + (AF/OF)(AE/OE) cosA; so that cos$a$ = cos$b$ cos$c$ + sin$b$ sin$c$ cosA. The three formulæ of this type inherently contain all possible relations between the sides and angles, as, for instance, sinA/sin$a$ = sinB/sin$b$ = sinC/sin$c$. From any formula another can be derived by changing a, b, c into $\pi - A$, $\pi - B$, $\pi - C$, and A, B, C into $\pi - a$, $\pi - b$, $\pi - c$. This is called the polar triangle transformation, the polar triangle A′B′C′ being the triangle whose vertices are the poles of the sides of ABC, with A and A′ on the same side of BC, and so on. It is easy to prove that $A' = \pi - a$, $a' = \pi - A$, etc., so that the transformation simply consists in applying a formula to the polar triangle. From the first formula given above, e.g., we deduce cosA = −cosB cosC + sinB sinC cos$a$.—Cf. M'Clelland and Preston, *Spherical Trigonometry*.

TRI'LOBITES. An extinct and widely distributed order of Palæozoic arthropods. Trilobites are especially characteristic of the Cambrian, Ordovician, and Silurian strata; a number of genera occur in the Devonian, but very few in the Carboniferous. They are named from the fact that the body is divided into three lobes, which run parallel to its axis. The number of body-segments varies greatly in different genera, and in some cases the animal could roll itself into a ball. For a long time no antennæ or limbs belonging to these animals were known, but researches undertaken in the United States have added greatly to our knowledge. The eye-lenses are frequently beautifully preserved. In *Phacops caudātus* each eye has 400 facets, and in *Asaphus tyrannus* 6000. The genera vary greatly in size, some being a few millimetres and others 50 centimetres long.

TRIM. The county town of Meath, Irish Free State, on the Boyne, 30 miles from Dublin. Pop. (1926), 1325.

TRIMDON. Urban district of Durham. A colliery centre, it is 8 miles S.E. of Durham and 249 miles from London by the L.N.E. Railway. Pop. (1931), 5410.

TRIMETHYLAMINE, C_3H_9N. A volatile liquid with a fishy odour, present in herring-brine and some species of flowers, usually manufactured from the vinasse of the beet-root sugar industry. It is used in the manufacture of methyl chloride, and as a cure for acute rheumatism.

TRINCOMALEE. A seaport of Ceylon, until 1905 a British naval station. Pop. 11,295.

TRING. A market town of Hertfordshire, England. It is an agricultural centre. Tring Park is the seat of Lord Rothschild, who has a fine zoological museum there. Pop. (1931), 4364.

TRINIDAD'. The most southerly island of the British West Indies, 6 miles from the Venezuelan coast of South America.

Physiography. Trinidad is hilly, and has three distinct ranges trending east and west as a continuation of those of the mainland: (1) the afforested northern range (rises to 3100 feet in Tucuche), (2) a low central ridge, and (3) the southern range (also afforested). All the rivers are small, and generally flow east or west. The

climate is healthy, and there are two seasons, the "dry" (beginning of February to middle of May) and the "wet" (May to January). The "wet," however, has a dry break of one month (the *Indian summer*), in October. About 76° F. is the mean annual temperature.

Area, etc. The total area is 1862 sq. miles, and the pop. is 412,738, of which about 133,277 are Indian coolie immigrants; the white element is mixed, and there is a lower class of Negroes and Chinese. These figures do not include Tobago (q.v.). The chief language is English, but a peculiar French *patois* and also Spanish exist side by side with it. Roman Catholics (under an archbishop) and Anglican (under a bishop) are the chief religions. Education is either governmental and secular or denominational (State-aided), and there are State and denominational colleges. British and United States gold is current, but British bronze and silver is almost exclusively used.

Towns. Port of Spain is the capital and chief port. San Fernando (pop. 9000) is also a port, and Arima (5000) is inland.

Communications. Port of Spain is the centre. All railways are on the 4-ft.-8½-in. gauge, and the total mileage is 118. The backbone of the system is the line Port of Spain-Arima-Sangre Grande (29 miles), from which a line projects at St. Joseph for San Fernando and Siparia. At Jerningham Junction, on the Siparia line, a branch is thrown off for Rio Claro (the Caparo Valley line). The Guaracara line (10 miles) is a branch of the Siparia line running to Princes Town, which is also served by the Cipero Tramway joining the line south of San Fernando, and forming a part of the railway system. There are wireless stations at Port of Spain, North Post, and Tobago.

Production. The exports, other than mineral, are chiefly cocoa, sugar, cocoanuts, molasses, bitters (Angostura, etc.), copra, and rum, all in order of value. There are several mud volcanoes and four mineral springs, but a great feature of Trinidad is the Pitch Lake of La Brea, 114 acres in size, which annually furnishes large quantities of asphalt (in 1931 the yield of asphalt was 123,138 tons, of which 94,584 tons, valued at £236,597, were exported). Fourteen companies are engaged in the production of petroleum, 341,022,570 gallons being produced in 1931, of which 92,971,043 gallons (valued at £411,498) were exported. There are two large oil refineries. Petrol spirit and kerosene are also exported. Imports include: textiles, flour, dried fish, rice, meat, machinery, hardware, lumber, and a quantity of gold from Venezuela in transit for Europe. One-third of all trade is with the United States, a quarter with Great Britain, and one-eighth with Canada.

Government. Trinidad includes Tobago for administrative purposes, the colony being called Trinidad and Tobago. There is a Governor, with an Executive Council (7 members) and a Legislative Council (appointed by the Governor).

History. Columbus discovered Trinidad (31st July, 1498), but the Spanish Governor did not take up duty until 1532. Raleigh pillaged the island, and on the whole it was a very uncomfortable place to live in until a British expedition conquered it in 1797. It became definitively British by the Treaty of Amiens (1802).

TRINIDAD. A Brazilian island in the South Atlantic, in 20° 30′ S. lat., 29° 50′ W. long., about 8 sq. miles in area. It is of volcanic origin and uninhabited, but has freshwater springs. About 30 miles due east are the Martin Vaz rocks (three), called after their discoverer, who landed in 1510. Trinidad was awarded to Brazil in 1895 on the grounds of its discovery in the sixteenth century by Tristan da Cunha.

TRINIDAD. A city of Colorado, United States, the county seat of Las Animas county, on Purgatory River; served by the Atchison, Topeka, & Santa Fé, the Colorado & Wyoming, and the Colorado & Southern Railways. It is a coal-mining centre, with coking-ovens, railway repair-shops, etc., and coal is shipped in large quantities. The adjacent region is also important for its stock-raising. Pop. (1930), 11,732.

TRINIDAD. A town of Santa Clara province, Cuba, about 4 miles north of Puerto Casilda (pop. 2000), its port. It has exports of sugar, rum, honey, and molasses, and coffee is produced locally. Trinidad was founded in 1514 as one of the first seven cities of Cuba, but pirates made it so unhealthy to live in that it was eventually removed inland. Pop. (1930, excluding suburbs), 13,851.

TRINITY. The Trinity, in Christian usage, means the conception of God as Father, Son, and Holy Spirit, i.e. the unity of the divine nature is regarded as containing distinctions of a threefold character. The grouping of deities in a triad is not, of course, peculiar to Christianity. The sacred associations of the number three, in the ancient world, led to various trinities. Thus Hinduism had Brahma,

Vishnu, and Shiva; the Egyptians had a family trio in Osiris, Isis, and Horus; and the Babylonians had triads. There were anticipations of the Christian Trinity even in Judaism, with its Alexandrian speculations about the Logos. But the Christian Trinity was not that of Father, Mother, and Son, although the mythological tendency, fostered by the later worship of the Virgin Mary, did sometimes tend in this direction, just as the original and essential Trinity "in more recent times is apt to be superseded as a practical object of devotion by the yet more human group (sometimes nicknamed the 'Jesuit Trinity') of Jesus, Mary, and Joseph, which is so vividly present to the popular religious imagination in Roman Catholic countries to-day" (C. C. J. Webb, *Problems in the Relations of God and Man*, p. 238).

The Christian doctrine of the Trinity is a doctrine which seeks to interpret experience, and the primary experience is that of faith in Jesus Christ as the supreme revelation of God, as the mediator who has restored a fallen world of men to unity with God, and in whom God has united Himself with humanity. This experience has carried with it from the first an overwhelming conviction of Jesus as divine. The problem is, how to reconcile faith in one God with the passionate belief that Christians cannot give any title to Jesus which is too exalted. Along with this goes the experience of God as Spirit, not simply as the immanent soul of the world, but as present in the Church. These implications are the germs of the later speculation, which eventually became crystallised into the doctrine of the Trinity. God the Father, revealed in God the Son, through God the Spirit—that seemed the best way of expressing the full content of the Christian consciousness.

The characteristic development of the "trinity" idea in Christian theology starts from the conception of the Incarnation. Where that is grasped vitally, the Trinity becomes intelligible; not otherwise. Hence the controversies from the fourth century onwards turned first on the person of Christ, and then on the Trinity. The one truth involved the other. Which corresponds to the order of experience? The faith in the Trinity originates in the personal relationship between the Christian and his Saviour, and so far as there is a genuine Trinitarian belief it depends upon this primary experience. Through Jesus and Jesus alone we understand what the Father is and what the Spirit means.

The Trinitarian doctrine may be and has been defended metaphysically and illustrated from psychology, but its soil lies in the personal religious consciousness of the Christian. "There is some real faith in the Incarnation," said Dr. Hort once (*Life of F. J. A. Hort*, vol. ii., p. 140), "left in various quarters, but in England the Trinity seems to have become the one great dogma. It has been killed, one fears, by that hapless *quicumque volt*, and its substitution of geometry for life." The evaporation of interest in the Trinity has always been due to mechanical or mythological statement of it, which have either removed it into the region of an unintelligible mystery or made it too narrow by falling into tritheistic expressions. And in both cases the failure ultimately has lain in the divorce of doctrinal speculation from experience or in an inferior type of experience.

The term was one of those introduced by Tertullian, who was apparently the first to use *trinitas* as an expression for the distinctions within the divine nature. These distinctions are real and eternal, not passing phases of God in relation to men, as Sabellius implied. The absolute nature of God is not the result of these distinctions or eventual interactions, but their ground. The unity of God's personality involves the distinctive "Father," "Son," and "Holy Spirit" as essential to the full self-expression of God. The relation of Christ as Son to the Father was not originally connected with paternity in the sense of other religions; the figures of "Son" and "Father" were used to denote the closest relation of being, in which one shares the life of another from whom he derives his existence and authority. Hence, when Arianism said that Jesus was merely a superman or secondary God, the Church replied that this was neither history nor religion; Jesus was God's Son, of the same essence as the Father. Similarly, the Holy Spirit as the active power of the Godhead in the Church must be personal; this is one inference, though it has never commanded the same convincing power as in the case of belief in the Father and in the Son. In any case, the formulated doctrine does not assert three separate wills or entities in the Godhead. "God in three persons" is more accurate than "three persons in God."

The imperfect sense of what we know as personality, and the difficulties connected with old associations of the Greek and Latin terms *hypostasis* and *persona*, have seriously handicapped the presentation of the Trinity; even in modern times the idea of personality is apt to be confounded with individuality, and ana-

logies are rarely helpful in explaining how one substance or essence in God is manifested in three distinct and yet interrelated modes.

The Trinitarian dogma, it is claimed, is the only one which does full justice to the implicates of the Christian experience; it completes theism by safeguarding it against deism on the one hand and pantheism on the other, but it also renders explicit the relation of the Christian to God through Christ and through the Spirit. "While the Son enables us to understand the being and action of personality within the Godhead, the Spirit enables us to conceive its being and action without. There is an immanent presence of God in man, but it represents personal agency, not impersonal energy. The God who abides in us is a person who is of the essence of the Godhead, and is ever translating its inner qualities and life into the form of one dependent yet related being" (A. M. Fairbairn, *Christ in Modern Theology*, p. 491). Thus the fullness of faith is completed.

"God was in Christ reconciling the world unto Himself;" "by Him we believe in God:" these instinctive expressions imply that Christ is more to us than any prophet or interpreter of God the Father. And, "because ye are sons, God hath sent forth the Spirit of His Son into your hearts, crying, Abba, Father," implies more than one influence. The Spirit completes the presence and revelation of Christ the Son. God's revelation begins by the manifestation of the Father through the Son, and is completed by the Spirit; the whole process must be equally divine, and it is the intuition of this, not any purely speculative interest, which has led to the Trinitarian doctrine.

The tendencies in modern thought which have tended to revivify interest in the Trinity, and at the same time to necessitate a restatement of its essential idea, are (*a*) mysticism; (*b*) metaphysics, with their speculations upon the absolute; and (*c*) the social interest, which points to a fullness of "social" life in the Deity. But fundamentally the pressure in favour of the Trinitarian view comes from experience, and by its capacity to meet experience it is justified. As Dr. James Drummond admitted, in his Hibbert Lectures on *Via, Veritas, Vita* (p. 203), it has always been the "reality of the fundamental Christian facts which imparted to the doctrine all its religious vitality," and there are certain elements in the classical Christian experience, already adumbrated in the New Testament, which may be said to result necessarily in some conception of God which is trinitarian.

BIBLIOGRAPHY: The ecclesiastical history of the doctrine is treated in books like Fisher's *History of Christian Doctrine* (Edinburgh, 1896), Harnack's *History of Dogma* (English translation, London, 1894 f.), and J. Tixéront's *Histoire des dogmes* (Paris, 1902); recent discussions in T. B. Strong's *Manual of Theology* (1892, chap. iv.), J. Orr's *Christian View of God and the World* (1893, chap. vii.), J. R. Illingworth's *Doctrine of the Trinity* (1907), W. Adams Brown's *The Trinity and Modern Thought* (1907), S. A. M'Dowall's *Evolution and the Doctrine of the Trinity* (1918), and C. Gore's *Belief in Christ* (1922, pp. 231 f.).

TRINITY COLLEGE (Cambridge) was formed by Henry VIII. in 1546 by the extension and consolidation of several earlier foundations. The college is the largest in the university. Of the long line of distinguished *alumni* may be mentioned Bacon, Barrow, Newton, Dryden, Cowley, Porson, Byron, Macaulay, Hallam, and Tennyson.

TRINITY COLLEGE (Oxford) was founded in 1554 by Sir Thomas Pope. It occupied the house and precinct of a Benedictine hall called Durham College, which was founded in 1286 and endowed by Bishop Thomas Hatfield in 1381. The front quadrangle lies open to Broad Street; there are modern buildings (1887) on the east side; on the north is the president's house and the chapel (1694) in a classic style. Among famous members of this college have been William Pitt, first Earl of Chatham; Cardinal Newman; and the historians Stubbs and Freeman. Randall Davidson, the late Archbishop of Canterbury, and Sir Arthur Quiller-Couch, King Edward VII. professor of English literature at Cambridge, were *alumni* of Trinity College.

TRINITY HALL. A college at Cambridge, founded by William Bateman, Bishop of Norwich, in 1350, incorporated by Act of Parliament in the reign of Elizabeth. "The Hall," as it is always called colloquially, has been for many centuries famous for its teaching of law, which is encouraged by several lectureships and studentships.

TRINITY HOUSE (London). A society incorporated in 1514 by Henry VIII. for the promotion of commerce and navigation, by licensing and regulating pilots, and erecting and ordering lighthouses, beacons, buoys, etc. The corporation is now empowered to appoint and license pilots for the English coasts, and has a general supervision over the corporations

which have charge of the lighthouses and buoys of Scotland and Ireland, subject to an appeal to the Board of Trade, to whose general superintendence the Trinity House is also subject in matters relating to England.

The corporation consists of a master, deputy-master, a certain number of acting elder brethren, with an unlimited number of younger brethren. The master and honorary elder brethren are chosen on account of eminent social position, and the other members from officers of the navy or the merchant service who possess certain qualifications. The corporation derives its revenue from lighthouse and other dues. Trinity House, on the north side of Tower Hill, London, was built in 1795.—Cf. W. H. Mayo, *Trinity House, London, Past and Present.*

TRINITY SUNDAY. The Sunday after Whitsunday. It was definitely established as a Church festival by Pope John XXII. in 1334. All the principal feasts occur in the half-year between Advent Sunday and Trinity, and all the Sundays from Trinity to Advent are called Sundays after Trinity.

TRIO. A composition, either vocal or instrumental, for three performers, or one written for a single instrument in three real parts. In this second case the instrument is generally the organ, and the best-known examples are Bach's six organ sonatas, in which each hand has a part, the third part being given to the pedals. In trios for three instruments the earlier examples were generally written for strings (Beethoven's five trios are excellent specimens), but with the advent of the pianoforte, combinations of that instrument with violin and 'cello came quickly into favour and have occupied the first place ever since. The best specimens are provided by the beautiful works of Beethoven, Schumann, and Brahms. The term trio is also applied to the middle, contrasting section of the typical march, or other piece of simple dance music.

TRIOLET. One of the fixed forms of verse invented in mediæval France; a stanza of eight lines, constructed on two rhymes, in which the first line is repeated as the fourth and seventh, and the second as the eighth. Its scheme of rhymes is therefore as follows: A, B, a, A, a, b, A, B (the capital letter represents the refrain). The triolet is the most exacting of all the fixed forms of verse, owing to its shortness and the delicate art which is required to introduce and reintroduce the refrain appositely. It is easy to write a triolet which complies with the rules; extremely difficult to write one whose art conceals its art. The triolet has been called a "tiny trill of epigrammatic melody turning upon its own innocent axis."

The inventors of the triolet used it for serious poems, but it has gradually been monopolised by the most trivial and ephemeral subjects. The triolet was reintroduced into English in 1873 by the future Poet Laureate, Mr. Robert Bridges. Its most successful exponent was Austin Dobson (1840-1921). In modern France the most celebrated writer of triolets was Théodore de Banville (1823-91). The following quaint example of an early triolet was found by Austin Dobson in an old French play:

Mon fils, Absalon,
Absalon, mon fils,
Las! perdu l'avon
Mon fils Absalon;
Il faut que soyon
En grief deuil confis
Mon fils Absalon,
Absalon, mon fils!

As an English example, the following by Austin Dobson cannot be bettered:

URCEUS EXIT

I intended an Ode,
And it turned to a Sonnet,
It began *à la mode*,
I intended an Ode;
But Rose crossed the road
In her latest new bonnet.
I intended an Ode,
And it turned to a Sonnet.

TRIPHENYL - METHANE, $CH(C_6H_5)_3$. A hydro-carbon in which three of the hydrogen atoms of methane (CH_4) are replaced by three phenyl (C_6H_5) groups. It may be prepared from chloroform and benzene in the presence of anhydrous aluminium chloride, and crystallises in colourless prisms. It is the mother-substance of an extensive series of dyes.

TRIPLE ALLIANCE. The origin of the Triple Alliance of Germany, Austria-Hungary, and Italy, which profoundly affected international relations in Europe from 1882 to 1914, is to be traced to the settlement that followed the conclusion of the Franco-Prussian War in 1871. The annexation of Alsace-Lorraine by Germany made a future war probable, and the rulers of the New German Empire were determined to secure their position by a system of alliances.

The first attempt in this direction was the League of the Three Emperors (Germany, Austria, and Russia), formed in 1871 and extended by an understanding with Italy in 1873.

But the divergence of Austrian and Russian interests became acute during the troubles in the Balkans, which were terminated by the Congress of Berlin in 1878, and although the three emperors continued to meet until 1885, Germany had by that time been compelled to choose between Austria and Russia. She chose Austria, and a secret treaty was negotiated in 1879, by which the two countries agreed to support each other in the event of a Russian attack upon either. At the same time, Bismarck encouraged Italy to seize Tunis, thus embroiling that country with France; and in 1882 Italy joined Germany and Austria, and the Triple Alliance was formed. Its existence was kept a profound secret, and did not become known until it was revealed in 1887 by *The Times*. The Alliance was renewed on several occasions, and was still in force when the European War broke out in 1914.

The object of Bismarck in the inclusion of Italy was to secure that France, when attacked by Germany, would be compelled to guard her Italian frontier, and, possibly, to engage in military operations there; but the event proved to be an illustration of his own saying that "international policy is a fluid element which, under certain conditions, will solidify, but, on a change of atmosphere, reverts to its original condition." Italian antagonism to France passed away, the ancient hostility to Austria reasserted itself, and some years before 1914 it was generally regarded as very doubtful if Germany and Austria could rely upon Italian support in the event of war. The renewal of the Triple Alliance was opposed in 1912 by the Nationalists in the Italian Chamber, and in the following year there was an agitation in the Italian press for its dissolution.

On the outbreak of war, Italy at once announced that she did not regard herself as bound by the terms of the Alliance to give assistance to the Central Powers, and declared her neutrality; but she did not secede from the Alliance until May, 1915, when the Italian Government brought the Triple Alliance to an end by denouncing the treaty with Austria and claiming freedom of action for Italy.

TRIP'OLI. The name of several towns. (1) A seaport of Libya, capital of the Italian province of Tripolitania. It is one of the oldest cities in the world, having been founded by the Phœnicians as *Œa*, and it was chief among the three cities (Œa, Leptis, Magna, and Sabrata) that formed the African Tripolis. The Roman colony *Œa Colonia* was founded in the first century, and was destroyed by the Aurusiani, a Libyan tribe, who also attacked *Leptis Magna*. After the Mahommedan conquest a new Moslem town sprang up with the old Roman name in an Arabic dialect as *Tarabulus*, which is still the Arabic name, although *al-Gharb* (of the West) is added, to distinguish it from Tripoli in Syria. Tripoli is the Mediterranean outlet for Darfur, Lake Tchad, Kano, and Timbuktu, and is the place upon which trans-Saharan caravan routes from these places converge. It is also the nodal point of the Tripolitanian railways. Pop. 60,000.

(2) A seaport of the Lebanon (q.v.), Syria. It was the *Tripolis* of the Phœnicians, the federal town of the three great cities of Tyre, Sidon, and Aradus, and the place where the great council of Phœnicia met on three occasions. Each of the cities had a separate walled-in quarter within the town. The Phœnician name has perished, and only the Greek form remains. In A.D. 638 the town fell to the Arabs, and thereafter figured largely in the Crusades. The modern Arabic name is *Tarabulus*. It was occupied by the British during the European War. Pop. 37,260.

(3) A town of Greece, sometimes called Tripolitsa. It derives its name as representative of the site of the ancient Arcadian towns of *Tegea*, *Mantineia*, and *Pallantium*, which stood on the modern Plain of Tripoli. Tripoli itself is not an ancient foundation. Pop. 11,500.

TRIPOLI. A material originally brought from Tripoli and used in polishing metals, marbles, glass, etc. It is yellowish-grey or white, rough to the touch, hard in grain but not compact, and readily absorbs water. It is usually composed of the minute frustules of diatoms, accumulated in lakes; but the term is also used for similarly fine-grained siliceous material resulting as a residue from the solution of limestone. *See* ROTTENSTONE.

TRIPOLITANIA AND CYRENAICA. Two discrete districts of Northern Africa which together form the Italian colony of *Libia Italiana*, or *Libya*.

Physical. Tripolitania comprises a coastal plain of sand-dunes and *sebkhas* (salt pans in the dry and lagoons in the wet season), backed by a line of rich oases. The coastal plain is divided into eastern and western sections; the eastern dune region, fringing the Gulf of Sidra and enclosing the Sebkha Tawerga, or Great Salt Marsh, swings westward at Misurata, and draws up abruptly some

6 miles east of Homs (Khoms), where the hills reach the sea; at Homs the hills end and the western coastal plain begins. Of the oases the best known are: Mensha (or Meshia), in which stands Tripoli town; Tajura, a westward extension of Mensha; Zliten; Misurata; Zanzur; Zawia; Bu Ajila; and Zwara.

Behind the coastal plain is the Jefara (sandy flats), a steppe-like region which has a breadth of 60 miles south of Zwara and narrows to 30 miles broad behind Tripoli town. These flats cover an area of approximately 5000 sq. miles, and rise in the south towards the steep crescentic escarpment of the Jebel or Main Plateau (2000 feet average altitude; Jebel Takuk, an isolated volcanic neck, 2800 feet altitude), a dissected plateau with four main divisions; (western) Jebel Nefusa; (central) Jebel Yefren and Jebel Gharian; (eastern) Jebel Tarhuna. At the foot of the mountains the intermittent rivers have brought down rich alluvial deposits, which spread on to the Jefara as delta fans.

Southwards from the Jebel is The Hammada al-Homra (40,000 sq. miles), the "red wilderness," an immense sloping plateau of red rock covered with small red stones. In The Hammada twelve years or even more may elapse between rainfalls. Bounding The Hammada on the south are the volcanic Jebel es-Suda or Black Mountains (Nabel es-Diruj, 4300 feet altitude) and their ramifications, which descend by abrupt terraces to the Fezzan basin, but rise again in the remote hinterland to merge in the main Saharan plateau. Its Saharan affinities is the chief characteristic of Fezzan,[1] for it comprises only a few oases, such as Murzuq, Tejerri, and Katrun, separated from each other by rocky plateaux covered by wildernesses of sand-dunes, and broken here and there by jagged ridges.

Cyrenaica is the richest region of Libya, and is physiographically the same as in the time of Strabo, despite all that has been written about desiccation.[2] It comprises a plateau, a tilted mass of Eocene limestone which, between Tolmeita and the Egyptian frontier, reaches the sea, to which it falls by two terraces, and is elsewhere separated from it by a very narrow coastal plain. Cyrenaica is a horst bounded by fault scarps. A series of powerful faults have caused the foundering of the extension of the plateau beneath the Mediterranean, and have formed the Bays of Sollum, Bomba, etc., as well as the Gulf of Sidra. According to Gregory, Cyrenaica consists essentially of a vast block of Eocene limestone capped by some outliers of Oligocene and Miocene, and fringed by low-level marine Pleistocene limestones. There are no pre-Cainozoic rocks in Cyrenaica.

The plateau has western and eastern divisions, named respectively Jebel Akhdar (Green Mountains; 2500 feet) and Jebel al-Akbar (Great Mountains; 700 feet average altitude). The northern versants of these are furrowed by many deep wadis, some forming hanging valleys, and in their process of cutting back the torrential intermittent streams have carved the northern face of the plateau into hill-like formations. The Jebel Akhdar, the ancient Marmaric highlands, slope to the Nile delta, and both divisions fall southward to the Aujila depression, which separates them from the Libyan Desert, a monotonous sandy waste containing the Kufara Oasis (*see* SENUSSI).

Along the seaboard of both Tripolitania and Cyrenaica there is a continuous drifting of sand, which has filled up many ancient harbours and has engulfed and obliterated once flourishing Roman towns such as Leptis Magna.

Climate, etc. The climate of Libya generally is Saharan, i.e. hot; but it is not unhealthy, and is made more bearable by the extreme atmospheric dryness of the three hottest months, May, June, and July. Cyrenaica is drier than Tripolitania. There are two seasons, wet and cold between November and April, and hot and dry from May to October, when there is no rain, and after June all plant life except oases shrivels up and is burnt by a remorseless sun. In Tripoli the climate of Jefara and Jebel is Mediterranean, with winter rains from November to February. Snow is not uncommon at Gharian, but south of the Jebel even rain is a rarity. Malaria is most prevalent adjoining the sebkhas and oases.

[1] Fezzan actually begins at the southern end of The Hammada, and extends southwards to the Tummo Mountains, its south-western extremity touching the Tazili Plateau. One striking physical feature of Fezzan is the wadis, which depart from the uniform trend from north to south of the Tripolitanian wadis, and run from west to east. The chief wadi is the Wadi Shiata. Down to the present day the Fezzani drive their cattle to pasturage on the shores of the Gulf of Sidra, as did their ancestors when the land was the classical *Phazania*, and the gulf the *Syrtis Major*. Fezzan was the land of the *Garamantes*, but during the wars of centuries the original people disappeared, and their degenerate representatives remain in the Jebel of Tejerri and other places. At Ghat congregate the Tuareg; and the negro is ubiquitous, in fact negro blood may be said to predominate, and few of the Fezzani are free from it.

[2] Cf. J. W. Gregory, *Is the Earth Drying Up?* in *Geographical Journal*, vol. xliii. (1914), pp. 148-72, 293-318 (with bibliography); also pp. 451-9.

Other common diseases are ophthalmia (from which nearly all Arab countries suffer), leprosy, tuberculosis and dysentery (from contaminated water, e.g. that brought down by the wadis during floods).

BIBLIOGRAPHY: (Physiographical) Dr. Adolf Vischer, *Tripoli*, in *The Geographical Journal*, vol. xxxviii. (1911), pp. 487-93 (with a short bibliography); J. W. Gregory, *Cyrenaica*, in *The Geographical Journal*, vol. xlvii. (1916), pp. 321-45 (with a bibliography, maps, and diagrams); H. J. Llewellyn Beadnell, *Sand Dunes of the Libyan Desert*, in *The Geographical Journal*, vol. xxxv. (1910), pp. 379-95 (with plates, diagrams, and maps); J. W. Gregory, *The Geology of Cyrenaica* (*Quarterly Journal Geographical Society*, part iv., vol. lxvii. (Nov., 1911).

Production: *Tripolitania.*—In the rich oases of the coastal zone the date-palm flourishes, and provides at once the staple food, two fermented liquors, fuel and building timber, leaves for basket-making and hut-thatching, and stones for crushing as a cattle fodder or for export to the ingenious Europeans who grind them for sale under the alluring title *coffee*. Olives, oranges, lemons, and fruit trees on the coastal plain, saffron, palms, olives, and esparto grass (*halfa*; *Stipa Tenacissima*) on the Jebel, and palms around the oases, are the chief products. Salt is worked in the *sebkhas*, and the coasts of both Tripolitania and Cyrenaica are rich in sponges, which have been fished since 1885. March to October is the main season. From *Fezzan* comes soda and potash.

In *Cyrenaica* salt is worked, and the date-palm flourishes on the narrow coastal plain, where, around Benghazi, the relics of the cypress and olive-plantations of the ancients are still found. This coastal plain may be regarded as a transition zone in which Mediterranean and African flora meet and intermingle. In the coastal oasis horticulture is carried on. Barley is an important crop in both Cyrenaica and Tripolitania, the surplus being in good demand by Scottish malsters for whisky production. In the hinterland there are large tracts of *halfa* as yet unexploited. Cattle, sheep, goats, donkeys (for work), horses (for riding), and camels (for food, hair, transport, etc.) are bred. According to Vischer, cattle are exported to Crete and Malta; but the main trade passes overland to Egypt. The future of Libya must be decided by agriculture alone, since of mineral wealth there is none.[1]

Railways. In Tripolitania the nodal point is Tripoli town, whence lines run: (1) to Homs via Tajura (75 miles), with a branch at Fornaci Junction for Ain Zara (6 miles); (2) to Gharian via Azizia (81 miles), with a branch Gheran Junction-Zwara (64 miles). All these lines are on the standard Italian colonial gauge of 3 feet 1⅛ inches, and are supplemented by lines of the Decauville type. Benghazi is the nodal point of the Cyrenaican railways to Derna (a standard-gauge line). Benina and Rejma are also served by standard gauge; but Derna and Benina are centres of Decauville systems, as are also Fort Artesian and Barka.

Towns: *Tripolitania.*—Tripoli is the provincial capital. Other towns and settlements are: Zanzur, Zwara (port), Zawia (a district head-quarters and wireless station, second only to Tripoli as an agricultural centre), Homs (a fairly modern town exporting *halfa*, and a former centre of the barley export to Great Britain), Ghargaresh (8 miles by rail west of Tripoli; a quarrying centre and wireless station), Tajura (in a coastal oasis), Misurata (a new Italian port about 7 miles east of the town; pop. 43,000; a former slave-port which exports carpets, dates, and cereals, and has weaving industries), Tawerga (an oasis of 14 sq. miles on the fringe of the great Tawerga Sebkha), Soite (a port), Nalut, Mizda, Gharian (centre of an olive and barley district), Tarhuna (a district head-quarters), and Azizia (an agricultural centre). Ghadames and Ghat are trading cities and caravan centres of the hinterland.

Cyrenaica.—Benghazi is the provincial capital (pop. 1931, 43,000). Other towns and places are: Marsa Susa (ancient *Apollonia*, port of Cyrene), Tolmeita (ancient *Ptolemais*; a modern port and garrison town), Derna (a port and railway centre; pop. 7000), Tobruk (the finest natural harbour on the North African seaboard), Sollum (on the Egyptian frontier), Merj (pop. 4000; the only Cyrenaican inland town of any consequence), and Bomba (a fine natural harbour, but inferior to Tobruk). The oasis of Jarabub was given to Italy by Egypt in 1926.

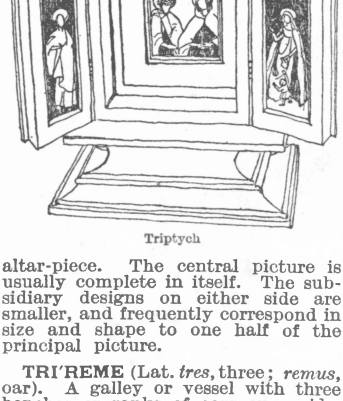
Government. For administrative and military purposes the colony is divided into two independent districts, Tripolitania (area, 347,500 sq.

[1] In classical times the rare plant *silphium* or *laserpitium*, the chief source of the gum-resin *laser*, much used by physicians of the time, was one of the chief Cyrenaican products, but the region was also famous for its ostriches and its honey, and large studs of horses were kept at Cyrene and at Barka, but especially at Barka, although there is a king of Cyrene mentioned by Pindar as a great horseman and winner of chariot-races. Silphium was, however, the staple product, and at its height Cyrene carried on a great trade in that commodity with Egypt and Greece.

miles; pop. 1931, 552,663) in the west, and Cyrenaica (area, 212,000 sq. miles; pop. 1931, 165,000) in the east. Each has its own Governor. There is a small local Parliament elected by universal franchise, and *all* natives are citizens and the political equals of those who are Italians by nationality. In penal cases the ordinary judicial law of Italy is invoked.

BIBLIOGRAPHY: *A Handbook of Libya* (compiled by the G.S. Naval Intelligence Staff: H.M. Stationery Office); *Peace Handbook No. 127* (in vol. XX.), *Italian Libya* (compiled for H.M. Foreign Office: H.M. Stationery Office). These are general handbooks on the geography, history, production, etc., of Libya. W. K. M'Clure, *Italy in North Africa*; G. Rohlfs, *Tripolitania*; Tullio Irace, *With the Italians in Tripoli* (deals with the Turco-Italian War).

TRIPTYCH (trip'tik; Gr. *triptychos*, folded thrice). A picture, carving, or other representation in three compartments side by side; most frequently such as is used for an

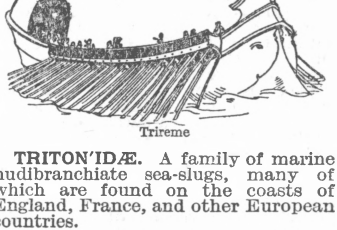


Triptych

altar-piece. The central picture is usually complete in itself. The subsidiary designs on either side are smaller, and frequently correspond in size and shape to one half of the principal picture.

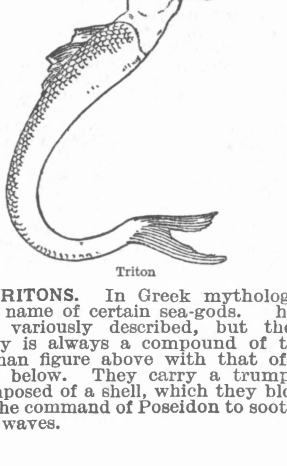
TRI'REME (Lat. *tres*, three; *remus*, oar). A galley or vessel with three benches or ranks of oars on a side, a common class of warship among the ancient Greeks, Romans, Carthaginians, etc. The trireme was also provided with a large square sail, which could be raised during a fair wind to relieve the rowers, but was never employed in action.

TRISTAN DA CUNHA (dâ-kun'yâ). The largest of three islands in the South Atlantic (the others being Nightingale and Inaccessible Island), about 1300 miles south-west of St. Helena. In 1817 it was occupied by Great Britain, and, after the death of Napoleon, practically the whole of the St. Helena garrison and some shipwrecked mariners moved to Tristan and founded a settlement. There is no administration, no crime, and no alcohol, moral rule being in the hands of the oldest inhabitant. There are cattle, sheep, and pigs; some poultry are raised, and potatoes and fruit-trees (apple and peach) are cultivated. Food-shortage is common. Area, 45 sq. miles (12 sq. miles habitable); pop. about 130.



Trireme

TRITON'IDÆ. A family of marine nudibranchiate sea-slugs, many of which are found on the coasts of England, France, and other European countries.



Triton

TRITONS. In Greek mythology, the name of certain sea-gods. hey are variously described, but their body is always a compound of the human figure above with that of a fish below. They carry a trumpet composed of a shell, which they blow at the command of Poseidon to soothe the waves.

TRI'UMPH. In Roman antiquity, a magnificent procession in honour of a victorious general, and the highest military honour which he could obtain. It was granted by the senate only to one who had held the office of dictator, or consul, or of prætor, and after a decisive victory or the complete subjugation of a province. In a Roman triumph the general to whom this honour was awarded entered the city of Rome in a chariot drawn by four horses, crowned with laurel, and having a sceptre in one hand and a branch of laurel in the other. He was preceded by the senate and the magistrates, musicians, the spoils, the captives in fetters, etc., and followed by his army on foot, in marching order. The procession advanced in this order along the *Via Sacra* to the Capitol, where a bull was sacrificed to Jupiter, and the laurel wreath deposited in the lap of the god. Banquets and other entertainments concluded the solemnity.

A naval triumph differed in no respect from an ordinary triumph, except that it was upon a smaller scale, and was characterised by the display of beaks of ships and other nautical trophies.

The lesser triumph, which was accorded to a victorious general who had not gained a victory decisive enough to be rewarded with a triumph, was known as *ovatio*. In celebrating an ovation the general entered the city on foot, wore a robe less gorgeous than that of the *triumphator*, and had a less distinguished retinue.

TRIUM'VIR. One of three men united in office. The triumvirs (Lat. *triumviri*) of Rome were either ordinary magistrates or officials, or else extraordinary commissioners who were frequently appointed jointly to execute any public office. But the men best known in Roman history as triumvirs were rather usurpers of power than properly constituted authorities. The term *triumvirate* is particularly applied in Roman history to two famous coalitions, the first in 59 B.C. between Cæsar, Pompey, and Crassus; the second in 43 B.C. between Antony, Octavian, and Lepidus.

TRIVAN'DRUM. A town of India, the capital of Travancore state, Madras Presidency. Pop. (1931), 72,784.

TRIV'IUM. The name given in the Middle Ages to the first three of the seven liberal arts—grammar, rhetoric, and logic.

TRNVO. A former capital of Bulgaria. Pop. 12,750.

TROCHU (tro-shu), **Louis Jules.** French general; born in 1815, died in 1896. He served in Algeria, and subsequently in the Crimean and Italian campaigns. At the outbreak of the Franco-German War (1870) he was made Governor of Paris, and when the Republic was proclaimed he was entrusted with the defence of the city, a position which he held until the capitulation. He wrote *Pour la vérité et pour la justice* (1873) and *L'Armée Francaise en 1879*.

TROG'LODYTE (Gr. *trōglodytēs*, cave-dweller, from *trōglē*, cave, hole, and *dyein*, to creep, enter). One dwelling in a cave or underground habitation. The ancient Greeks gave the name to various races of savages inhabiting caves, especially to the cave-dwellers on the coast of the Red Sea and along the banks of the Upper Nile in Nubia and Abyssinia, the whole of this district being known by the name Troglodytikē. Archæological investigations show that cave-dwellers everywhere probably preceded house-builders. *See* CAVE-DWELLERS.

TROGON. A genus of birds, the type of the family Trogonidæ, of the woodpecker order (Coraciiformes). Trogons inhabit the forests of the

Trogon (*Trogon Narina*)

intertropical regions of both hemispheres. There are numerous species, all of them possessing most brilliantly coloured plumage. *See* QUEZAL.

TROLLOPE, Anthony. English novelist, born in 1815, died in 1882.

He came of a literary family, of which the most distinguished members were (1) his mother, Frances Trollope (1780-1863), a prolific writer, famous for her novels *The Vicar of Wrexhill* and *Widow Barnaby*, and notorious for her book on the *Domestic Manners of the Americans*; and (2) his elder brother, Thomas Adolphus Trollope (1810-92), whose innumerable novels include *La Beata* and *The Garstangs of Garstang Grange*.

Anthony Trollope was educated at Winchester and at Harrow, where he had a miserable existence as a day-boy and learnt next to nothing. In 1834 he was appointed to a clerkship in the Post Office; he remained an active and efficient civil servant for thirty-three years, and introduced many new ideas into his department. He is said to have invented the pillar-box. His official duties kept him for several years in Ireland, took him all over the west of England and South Wales, and eventually carried him on trips abroad, to the West Indies and elsewhere. A life of this kind suited his temperament admirably, and provided him with abundant material for novels and books of travels.

Novels. His first two novels, which dealt with Irish life, fell flat; and it was not until the publication of *The Warden* (1855) that Trollope became famous. This was the first of that series of Barsetshire novels which constitutes Trollope's chief claim to immortality. The other members of the series are: *Barchester Towers* (1857), *Doctor Thorne* (1858), *Framley Parsonage* (1861), *The Small House at Allington* (1864), and *The Last Chronicle of Barset* (1867). Amongst his other novels, upwards of sixty in number, the best known are *Orley Farm* and *The Three Clerks*. He also wrote an inadequate life of Cicero; a book on *The Commentaries of Cæsar*, in the Ancient Classics for English Readers Series; and a lukewarm life of Thackeray for the English Men of Letters Series.

Literary Methods. In his *Autobiography* (posthumously published in 1883, but written 1875-6) Trollope gave a disillusionising account of his literary methods. He trained himself to write 250 words in a quarter of an hour, so that by working three hours a day, mainly before breakfast, he could produce a daily ration of three thousand words, and thus publish on an average three novels a year. His day, in fact, was portioned out like that of King Henry VI.'s homely swain:

> So many hours must I tend my flock;
> So many hours must I take my rest;
> So many hours must I contemplate;
> So many hours must I sport myself.

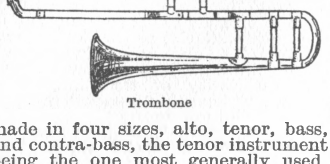
Trollope gained over £70,000 by his novels. He made a great tactical error in taking the public into his confidence about his methods of composition. He lost his glamour and his audience, and found himself in the position of a conjuror who has explained his tricks. It is, however, possible that there was a certain amount of irony in his insistence upon the more material aspects of authorship. He was an indefatigable civil servant, and yet he wrote that he felt "the necessity of travelling miles enough to keep his horses" (he was paid by the mileage).

Appreciation. Trollope wrote too much and too fluently; but his best work is very good. He is not a master of his art like Fielding or Smollett; but he might not inaptly be described as a masculine and clumsy Jane Austen. He has been accused of being a realist; it has been said of him that he never creates, he only depicts, and that his books are mere transcripts from life. This is not true; he was a day-dreamer, who had a happy knack of being able to commit his dreams to paper. He said himself, "To me Barset has been a real county, and its city a real city, and the spires and towers have been before my eyes, and the voices of the people are known to my ears, and the pavements of the city ways are familiar to my footsteps." Trollope is pleasantly free from exaggeration; and two of his characters at least—Josiah Crawley and Mrs. Proudie—are fit to stand beside any characters in English fiction. He gives a most faithful picture of the society of his time.—BIBLIOGRAPHY: T. H. S. Escott, *Anthony Trollope*; G. Saintsbury, *Three Mid-Century Novelists*; Sir Leslie Stephen, *Studies of a Biographer*.

TROLLS. In Northern mythology, a name of certain supernatural beings, in old Icelandic literature represented as a kind of giants, but in modern Scandinavia regarded as of diminutive size, and represented as a kind of mischievous imps or goblins.

TROMBONE. An instrument of the trumpet family, its tube being cylindrical and not conical, as is the case in brass instruments of the horn class. The essential feature of the trombone is the slide, by means of which the effective length of the instrument may be varied at the will of the performer. The notes of the harmonic series are alone used, and any note may be taken as a natural harmonic in one or other of the seven "positions" of the slide. In moving from any position to the next the pitch of the instrument is altered by one semitone, and as the exact amount

of movement in every case is decided entirely by the ear and experience of the performer, there is scope for great artistry in trombone playing. There is a complete chromatic range of two and a half octaves. Trombones are



Trombone

made in four sizes, alto, tenor, bass, and contra-bass, the tenor instrument being the one most generally used. The tone of the trombone is rich and noble in quality, and the quantity is under very sensitive control.

TROMP, Martin Harpertzoon van. Dutch sailor; born at Briel in 1597, died in 1653. He went to sea with his father in 1607; received the appointment of lieutenant-admiral; gained a decisive victory over the Spanish and Portuguese fleet near Dunkirk in 1639; encountered Blake and Monk in 1653, and in the same year he again encountered Monk and was killed in the battle.

TROMSÖ (trom'*seu*). A northern county of Norway between Finmark and Nordland. Area, 10,045 sq. miles; pop. (1930), 97,467.

TROMSO. A seaport of Norway, capital of the province of Tromsö, situated on a small island of the same name off the west coast. It has an extensive trade in fish, train-oil, etc. Pop. (1930), 10,336.

TRONA. A hydrous sodium carbonate, $Na_2CO_3{\cdot}HNaCO_3{\cdot}2H_2O$, occurring in dry lands. Like its ally, *thermonatrite*, $Na_2CO_3{\cdot}H_2O$, it is injurious to vegetation, and promotes an unfavourable clayiness in the soil.

TRONDHJEM. A seaport on the west of Norway, the ancient capital of the country, at the mouth of the Nid, on the south side of the Trondhjem-fiord. It was renamed Nidarosas in 1930, but the change was not popular. The adjacent island of Munkholm and the mainland have fortifications. The chief buildings are the cathedral, the finest church in Scandinavia, founded in the eleventh century over the tomb of St. Olav; and the Kongsgaard, or palace of the old Norwegian kings (now an arsenal). The trade consists chiefly in exports of timber, dried and salted fish, tar, and copper. The city has a broadcasting station (493·4 m., 1·2 kw.). Pop. (1930), 54,458.

TROON. A burgh seaport of Ayrshire, Scotland. It is a favourite seaside resort, and has fine sands, golf-courses, and a harbour and shipbuilding yards. Pop. (1931), 8544.

TROOPIAL. The name common to a group of perching birds belonging to the family Icteridæ. They mostly inhabit the southern United States, but several of them appear as birds of passage in the northern states in early spring. The cow-troopial, cow-bird or cow-bunting, the blue-bird, and the bobolink or rice-bunting, belong to this group. Most of the cow-birds (Molothrus), are nest parasites, like cuckoos.

TROPÆ'OLUM. A genus of handsome trailing or climbing plants, nat. ord. Geraniaceæ. The species are all inhabitants of South America. Some of them have pungent fruits, which are used as condiments, and others are prized for their handsome and various-coloured flowers. The principal species are *T. minus*, small Indian cress, and *T. majus*, great Indian cress. *See* NASTURTIUM.

TROPHY. In antiquity, a monument or memorial in commemoration of some victory. It consisted of some of the arms and other spoils of the vanquished enemy, hung upon the trunk of a tree or a stone pillar by the victorious army. The custom of erecting trophies was most general among the Greeks, but it passed at length to the Romans. It was the practice also to have representations of trophies carved in stone, in bronze, or similar lasting substance. In modern times trophies have been erected in churches and other public buildings to commemorate victories, or heroic action in war.

TROPICAL DISEASES. The community aspect of the medical sciences is nowhere more extensively and strikingly exemplified than in the study of the diseases of tropical countries. Ever-increasing numbers of the peoples of the Mediterranean basin have sought to exploit the resources of the tropics, first the Egyptians and later each rising Western empire, in the interest of their common civilisation. The material advantage has been incalculable, yet it cannot be said that the white man of temperate climates has even now, after a struggle extending over thousands of years, succeeded in making a permanent home for himself and his descendants in a single region of the tropics.

Solitary and the victim of disease, he returns exhausted to end his days in a temperate climate, or soon proves his vulnerability in a tropical grave.

It is needless to say that this susceptibility to the tropical environment is peculiar, not extending to other races, for the most part highly pigmented in skin and hair and eyes, which an age-long process of selection or adaptation or both has endowed with exceptional powers of resistance or qualities of immunity.

If the expression *tropical disease* is no part of a rational classification according strictly to distribution alone, it has nevertheless a singular validity in defining one of the gravest biological problems confronting civilised man. From this point of view it should not include diseases even so important as leprosy, cholera, and plague, which would thrive elsewhere were the social and sanitary conditions there equally favourable.

Nor, according to Sir Patrick Manson, is there any disease, apart from traumatism, definitely attributable to the direct action of a high temperature upon the human body. The limitation of certain diseases to warm climates is with rare exceptions in no sense dependent on the action of temperature, or food, or social conditions, or the action of temperature on a disease germ while it is resident within the human body, but depends directly or indirectly on the requirements of the germ outside the body and during its passage from one human being to another.

The recognition of this fact has contributed more to our ability to contend successfully with many tropical scourges than anything else; but it also awakens us to the many dangers inherent in the disseminating influences of modern means of communication. Of the generality of tropical diseases, the European is immune from none, and the native races themselves possess an immunity which is only local and specific.

Modern communication and trade have unwittingly supplied over and over again the complicated conditions essential to spread. While these accidents have enormously increased our knowledge of the etiology of tropical diseases in general, and hence our power to combat them, the knowledge sometimes comes when it is too late, or in circumstances in which it cannot be applied, as in the recent extension of the area of sleeping sickness.

Preserving our definition of tropical diseases as those of parasitic origin in which the parasite depends for its existence upon a high temperature during its passage from one human host to another, we find that *bacteria* are responsible for few, and that these few—Malta fever for example—have a distribution unusually limited. Fungi, protozoa, and helminth worms account for the vast majority.

Of the fungi, *Tinea imbricata* (Manson) gives rise to a tropical ringworm endemic in the Malay Peninsula and the South Sea Islands, whence it has spread to the East Indies, China, the Straits Settlements, and, more recently, Brazil. It is mainly confined to the Papuans and Malays. A pigment-bearing fungus causes *pinta*, a skin disease characterised by the appearance of variously coloured patches in the skin. It has a wide tropical distribution.

A very large number of tropical diseases are protozoan in origin, notably amœbic dysentery, malaria, with the severe form of it called jungle fever, yellow fever, and trypanosomiasis. Whereas the bacteria tend to a wide distribution, being highly resistant organisms with no climatological factor in their life-history and giving rise to diseases difficult or impossible to cure, like tuberculosis and leprosy, the protozoan parasites are distinguished by an attachment, in many cases marvellously complex, to a definite environment.

Thus malaria is dependent upon the existence of infected anopheline flies, the infection of the flies upon the presence in the neighbourhood of infected natives, and the existence of the flies themselves upon the proximity of suitable breeding-pools. Trypanosomiasis, similarly, requires for its development a dual system of hosts for the parasitic *trypanosoma* in the healthy big game of the fly belt, and the tsetse fly which inoculates man. Hence arises the supreme importance of the life-history of each pathogenic protozoan.

Stephens writes: "It is possible for every one who will exercise the necessary intelligence and care to escape malaria completely." If it is unhappily impossible to refer in such positive terms to all other protozoan diseases, it is nevertheless true that the prospect of a private and a public prophylaxis, based upon full knowledge and understanding of the habits of the parasite concerned, is leading to a more hopeful attitude towards the problem of tropical disease than marked the beginning of the century or even of the past decade.

Moreover, if the essential interdependence of several factors in the environment of the protozoan renders the parasite biologically vulnerable, it is also individually so to a far greater extent than the resistant bacterium.

Not only is quinine to all intents and purposes a specific remedy in malaria, but arsenic and antimony

between them (the latter by intravenous injection of the tartrate) have now proved themselves of high value in the treatment of an ever-increasing list of tropical infections, which now includes some of those associated with the third great group of man's tropical enemies, the helminths.

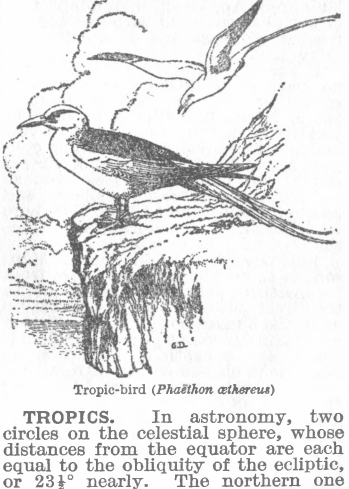
Such of these as can pass from host to host in any climate, like the common intestinal worms, are cosmopolitan. Others, however, need a tropical temperature for their intermediate processes of development. In the case of *Ankylostoma duodenale*, the worm discovered by Dubini in 1838, and later called the "tunnel worm" from its association with a deadly outbreak among the St. Gothard tunnel workers in 1880, a high temperature and the presence of moisture are both necessary for the development of the ova.

There are, further, helminth worms which require intermediary hosts which, unlike those of the various tape-worms (tænia), are themselves limited to a tropical environment. Bilharziasis, filariasis (*see* ELEPHANTIASIS), dracontiasis, and distomiasis are among the diseases caused by parasites of this kind, and are true tropical diseases accordingly.

How extensive have been the researches associated with the effort in recent years to solve the problem presented by the tropical diseases is illustrated by our knowledge of the blood-sucking flies. Of mosquitoes alone over 800 have been described, but very few of these are known to be concerned in the infection of human beings, e.g. *Stegomyia fasciata*, the "tiger-mosquito," the carrier of yellow fever, members of the genera Anopheles, Myzomyia, Pyretophorus, Myzorhynchus, Nyssorhynchus, and Cellia (malaria), and Culex, Mansonia, and Tæniorhynchus (filariasis). Important schools for the study of tropical medicine are established in London and Liverpool.

BIBLIOGRAPHY: Sir R. Ross, *Memoirs, with a full account of the malaria problem and its solution*; Manson, *Tropical Diseases*; A. Castellani and A. J. Chalmers, *Tropical Medicine*.

TROPIC-BIRD, or BOATSWAIN-BIRD. The common name of the aquatic birds belonging to the genus Phaëthon, family Phaëthontidæ, of the stork order (Ciconiiformes), peculiar to tropical regions. There are only three species, the *P. æthereus*, *P. flavirostris*, *P. rubricauda*. They are distinguished by two very long slender tail-feathers. They are wonderfully powerful on the wing, being able to pass whole days in the air without needing to settle.



Tropic-bird (*Phaëthon æthereus*)

TROPICS. In astronomy, two circles on the celestial sphere, whose distances from the equator are each equal to the obliquity of the ecliptic, or 23½° nearly. The northern one touches the ecliptic at the sign Cancer, and is thence called the *tropic of Cancer*, the southern one being for a similar reason called the *tropic of Capicorn*.

The sun's annual path in the heavens is bounded by these two circles, and they are called *tropics* because when the sun, in his journey northward or southward, reaches either of them, he, as it were, *turns back*, and travels in an opposite direction in regard to north and south. Geographically the tropics are two parallels of latitude, each at the same distance from the terrestrial equator as the celestial tropics are from the celestial equator. The one north of the equator is called the tropic of Cancer, and that south of the equator the tropic of Capicorn. The word tropics is popularly applied to the region included between the two parallels.

TROPPAU (now called **OPAVA**). A town of Czechoslovakia, formerly capital of the Duchy of Silesia, Austria, on the Oppa. The manufactures consist chiefly of woollen and linen cloth, beet-sugar, beer, liquors, etc. Pop. (1930), 36,083. *See* TESCHEN.

TROSSACHS (tros'aks). A beautifully wooded mountain pass in

Perthshire, Scotland, extending for 1 mile west from Loch Achray to Loch Katrine, and situated 8 miles west of Callander. The beauty of the scenery has been immortalised by Scott in *The Lady of the Lake.*

TROTSKY, Lev. The assumed name of Leiba Bronsteĭn, a Jew, Russian Communist (Extreme Left), born in the government of Kherson, 1877. Expelled from his university, he was banished to Siberia (1898-9), but escaped, and during the revolutionary phase of 1905 became vice-president of the Petrograd Soviet of Workmen. On the triumph of the Tsar, Trotsky was exiled to Siberia for life, but again escaped, and threw himself wholeheartedly into the forlorn hope of the Communist cause.

The Revolution of 1917 gave him his chance, and after one abortive attempt to enter Russia, during which he was arrested by the British Government and interned at Halifax, but subsequently released on the representations of Milyukov, he reached Leningrad in May, 1917. A prominent partisan in the futile attempt to overthrow the Kerensky régime (July, 1917), he was thrown into jail, but, for some unaccountable reason, his release was almost immediate, and he triumphed after the *coup d'état* of Oct., 1917.

Trotsky at this point became Minister for Foreign Affairs, and although his name is generally coupled with that of his more moderate friend Lenin as symbolical of bolshevism and anarchy, he was Lenin's most bitter opponent, and belonged to the Extreme Left party under the leadership of Bukharin. No half measures and no conciliation would suit Trotsky.

Very soon the world was afforded the unique spectacle of an anti-militarist and pacifist changing his opinions; and Trotsky blossomed forth as Commander-in-Chief of the Red army and, for a pacifist, an exponent of surprising militaristic methods. In 1925 he was removed from his office of Commissary for War. In 1927 he was expelled from the Communist Party and exiled to Turkestan. In 1929 he went to Istanbul. He was refused permission to live in England or Denmark, but was granted leave to reside in Spain in 1931. In January of 1932 he was banished for two years by the Soviet Government. He lectured in Copenhagen on Communism in 1932.

TROTTING. A sport which, in both Canada and the United States, is the chief substitute for British horse-racing. The first recorded trotting-match was run in 1818, the winner being Boston Blue, who covered the mile in 3 minutes. In 1905 Lou Dillon reduced the time to 1 minute 58¼ seconds; while eight years later Uhlan achieved the record

Trotting: American Sport

of 1 minute 54⅕ seconds, windshields, however, being employed.

All "trotters" seem to trace their pedigree to the thoroughbred English horse Messenger, imported into the States in 1788. Trotting is essentially an artificial pace, acquired by special training. The horse is run in a small two-wheeled buggy, often weighing not more than 40 lb. In England, though high-actioned trotters are exhibited at shows, the cult of "trotting" is comparatively little followed. American trotting is controlled by the National Trotting Association, founded in 1869.

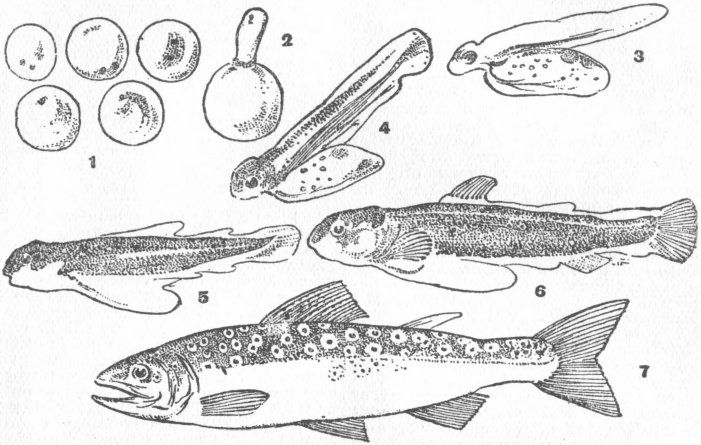
TROU'BADOURS. Mediæval poets of Southern France, who flourished between the eleventh and fourteenth centuries. They employed the *langue d'oc,* and are thus distinguished from the *trouvères,* who wrote in the *langue d'oïl.* They were called troubadours (finders) because they invented new melodies, new metrical forms, and new variations for their lyrical improvisations, which, in the end, became exceedingly artificial.

The feudal and social conditions of Provence were particularly favourable to the development of the troubadours (*see* PROVENCAL LANGUAGE AND LITERATURE). The famous troubadours usually employed *joglars* (or jongleurs) to recite their poems, whilst many, who had to earn their living and depended upon the generosity of their patrons, were themselves jongleurs, accompanying themselves on the instrument.

The chief patrons of the troubadours were the Counts of Provence,

the Counts of Toulouse, and the Kings of Aragon and Castile, and many knights, barons, and counts were to be found among the troubadours. William IX., Count of Poitou, is supposed to have been the first troubadour. The lyrical poetry of the troubadours was essentially a court poetry, improvised for elegant and aristocratic audiences, never for the people.

In their songs the troubadours dealt with politics and war, indulged in satire, and preached crusades, but their principal theme was love.



The Development of the Trout

1, The eggs. 2, Just hatching. 3, Just hatched. 4, Three days old. 5, Fifteen days old. 6, Five weeks old. 7, Full grown.

This they conceived as a sort of cult, almost a religion, love being the suzerain and all lovers his subjects. The love-songs of the troubadours were mostly addressed to married women. Their devotion was supposed to have been conventional and platonic, the lover being considered as a knight in the service of the beloved. The *genres* cultivated by the troubadours were: the *canzone*; the *sirventés*, or songs in the service of an overlord; the *plank*, or funeral song; and the *tenso*, or dispute.

Of the four hundred troubadours the most eminent were: Geoffray Rudel, Bernart de Ventadour, Bertrand de Born, and Peire Cardenal. The lyric poetry of Northern France was influenced by that of the troubadours, and so were the poetry of the minnesingers and the early middle-English lyrics.—BIBLIOGRAPHY: H. J. Chaytor, *The Troubadours of Dante*; J. F. Rowbotham, *The Troubadours and the Courts of Love.*

TROUT. The name of certain species of Salmo which differ from salmon in minor structural characters, such as the possession of fewer rays to the dorsal fin and more rows of scales on the tail. Only one British species, *S. trutta*, is recognised, but this includes a number of varieties or races, some of which live entirely in fresh water, while others—the so-called sea trout—only visit rivers for the purpose of spawning.

Among the varieties may be mentioned: brook trout (*S. fario*); sea trout (*S. eriox*), including the sewen or western race (*S. cambricus*) and the phinock or eastern race (*S. albus, S. brachypoma*); estuarine trout (*S. estuarius*, etc.); great lake trout (*S. ferox*); gillaroo of Ireland (*S. stomachichus*); Loch Leven trout (*S. levenensis*); and black-finned trout (*S. nigripinnis*) of some Welsh lakes.

Trout in some cases attain a maximum weight of 50 lb. The British species ranges through Europe into Persia and the northern slopes of the Himálaya, being also found in Algeria. The breeding habits of the migratory varieties resemble those of the salmon, but, unlike this, sea trout feed voraciously in fresh water.

Allied species are native to Japan and the Pacific slope of North America, one of the latter being the Californian rainbow trout (*S. irideus*),

which has been introduced into this country, and is recognisable by the presence of spots on the caudal fin. Trout are delicately flavoured, and afford excellent sport.

TROUVÈRE (trō-vâr ; Fr. *trouver*, to find, compose). A name given to the ancient poets of Northern France, corresponding to the *troubadours* of Provence. Their productions were of a narrative or epic character, and thus contrast broadly with the lyrical, amatory, and more polished effusions of their southern rivals. The trouvères were usually men of rank and standing, knights or priests.

TROUVILLE (trō-vēl). A seaport and favourite French bathing-place, in the department of Calvados, at the mouth of the Toucques. It is contiguous to Deauville. Pop. 6900.

TROVER. In English law, an action against a man who is in possession of the goods of another, and refuses to deliver them to the owner. Strictly, an action brought by the owner of goods against a finder who has converted them to his own use, for payment of their value.

TROWBRIDGE. An urban district and market town of Wiltshire, England, on the Biss. In the parish church there is a monument to the poet Crabbe, who was rector there from 1814 to 1832. The manufactures are chiefly in woollens ; engineering and brewing are carried on. Pop. (1931), 12,011.

TROY. The most famous city in literature, the scene of the ten years' siege by the Greeks sung by Homer, was a town in the Troad in Asia Minor, 3 miles south of the Hellespont and about the same east of the Ægean Sea. Even in ancient times the site was disputed, and the two-thousand-year-old controversy was only settled at the end of the nineteenth century by the researches of Schliemann (q.v.). Its site is marked by the mound of Hissarlik, originally a rocky hillock, some 50 feet high, doubled in height by the accumulated debris of successive settlements.

Schliemann began his twenty years' work in 1872 by digging a great trench from the north through the debris at Hissarlik down to the solid rock. The section showed nine different strata, corresponding to nine successive occupations of the site, which, following Schliemann, it is usual to call " cities," although the smaller were mere villages and the larger more in the nature of citadels. There was no considerable town at Troy till Roman times.

The earliest settlement was proved by the remains found to belong to the Neolithic period and may have existed into the beginnings of the Bronze Age. The second city was much more important and revealed a high degree of culture, that of a wealthy people at the zenith of the Bronze Age. It was occupied for a long period. The great wealth of gold ornaments found in various hoards, notably the so-called " royal " treasure, led Schliemann to believe that this was Homer's Troy.

Its buildings of clay and wood were finally destroyed by a great conflagration. The third, fourth, and fifth settlements were unimportant and bring us down to the beginning of the Mycenæan age.

The sixth city with its great towers, walls, and gateways of hewn stone, at first thought to belong to about the sixth century B.C., is now known to be the Iliad's " well-walled " Troy, although this was only established after Schliemann's death by his successor Dörpfeld, for whose work funds were provided by Schliemann's widow and the Emperor William II.

The pottery found and the masonry work date it in the late Mycenæan age, about 1500-1200 B.C. It bears abundant evidence of having been destroyed by an enemy, and the latest date for its occupation agrees well with the traditional date for the fall of Troy.

The seventh city offers many problems, and has afforded interesting confirmation of the tradition of a Thracian invasion of Asia Minor. The eighth settlement brings us into historic times. It is that of an Æolian colony founded in the eighth century B.C., which led an uneventful existence till its complete destruction by the Roman general Fimbria in 89 B.C. Under the Cæsars an era of great prosperity began, for the emperors gave the new town, now called Ilion, many privileges as the home of their ancestor Æneas.

With the advance of Christianity this town seems to have gradually decayed, as its associations and great temple of Athene lost their appeal, so that in course of time " wide-wayed " Troy was forgotten, and the Turks gave a new name to the grassy mound which it became.—
BIBLIOGRAPHY : Schuchhardt, *Schliemann's Excavations* ; Dörpfeld, *Troja und Ilion* ; W. Leaf, *Troy : a Study in Homeric Geography*.

TROY. A city of New York, United States, the county seat of Rensselaer county, on Hudson River ; served by the Boston & Maine, New York Central, and Delaware & Hudson Railways. Industrially, Water-

vliet, Cohoes, and Waterford, on the opposite bank of the river, are practically one with Troy. Collars and cuffs and shirts are the chief manufactures. Settled in 1659, Troy was chartered as a city in 1816. Pop. (1930), 72,763.

TROY. A city of Ohio, United States, the county seat of Miami county, on the Great Miami River; served by the Cleveland, Cincinnati, Chicago & St. Louis, and other railways. It is the centre of a tobacco-growing region, and is semi-industrial, using power generated by the Miami & Erie Canal. Settled in 1807, it became a city in 1890. Pop. 10,000.

TROYES (tro-à). A town, France, capital of the department of Aube, on the Seine; served by the Belfort line of the Eastern Railways. Manufactures chiefly consist of cottons, woollens, hosiery, soap, artificial flowers, paper, and gloves. Troyes was in existence previous to the conquest of Gaul by the Romans, by whom it was called *Augustobona*. The Treaty of Troyes between Charles VI. and Henry V. of England was concluded in 1420. Pop. (1931), 58,804.

TROY WEIGHT. A weight chiefly used in weighing gold, silver, and articles of jewellery. The pound troy contains 12 ounces; each ounce is divided into 20 pennyweights, and each pennyweight into 24 grains. Hence the pound contains 5760 grains, and the ounce 480 grains.

TRUCE. A suspension of arms by agreement of the commanders of opposing armies; a temporary cessation of hostilities, either for negotiation or other purpose. The *truce of God* was a suspension of arms which occasionally took place in the Middle Ages, and was introduced by the Church in order to mitigate the evils of private war. This truce provided that private feuds should cease at least on the holidays from Thursday evening to Sunday evening each week, during the season of Advent and Lent, and on the octaves of the great festivals.

TRUCIAL OMAN. Those petty states (Abu Thabi, Dibai, Sharja, 'Ajman, Umm al Qaiwan) lying between Oman and El Qatar in Arabia, along the Gulf of Oman and the Persian Gulf; under British protection since 1892.

TRUCK ACTS. Acts passed in 1831, 1887, and 1896 prohibiting the payment of wages to workmen otherwise than in money. The Acts strike at the giving of goods as a "reward of labour," and do not prevent the supply of materials to a workman to be used up in his work, or the making of gifts which are not in lieu of wages.

The right of an employer, however, to contract with an agricultural labourer to give him food, drink (other than intoxicants), house accommodation, or other privileges in addition to money wages, as remuneration for his services, is expressly saved. Conditions imposed by an employer as to the place or manner in which his workmen shall expend their wages are void.

An employer, however, is not prohibited from selling goods to his workmen for cash, provided they deal with him of their own free will and not as a condition of their employment; but if he gives credit he cannot sue for payment nor deduct the amount due from wages nor set it off against a claim for wages.

By the Act of 1896, limitations are placed on the imposition of fines and deductions for negligent work. The Acts apply to all employees engaged in manual labour, except domestic servants. A person is engaged in manual labour if that is the main scope of his employment. Thus a clerk, an omnibus conductor, and a shopman engaged in selling goods, all of whom may at times have to do manual labour in the course of their duties, have been held to be outwith the scope of the Acts.

TRUFFLE. A common name of fungi with underground tuberous fruit-bodies having a strong scent and flavour, and generally edible. The truffles so highly esteemed by epicures are species of Tuber, a genus of Ascomycetes, family Tuberineæ. They grow abundantly in the South of France (especially in the Perigord district) and in Italy, and are collected for the market with the aid of swine or specially trained dogs, which scent them out and scratch them up. Truffle-fruits are also borne by Elaphomyces and certain Gastromycetes.

TRUJILLO. A seaport of Honduras, on the Caribbean, a centre of the fruit trade with the United States. It was founded in 1524, and was a Spanish naval station and a place of great importance; but during the seventeenth century the ravages of pirates encompassed its downfall. Pop. 2000.

TRUJILLO. A city of Peru, capital of the department of Liberdad; served by rail to the port of Salaverry (10 miles). Cigars and cigarettes are manufactured. Francesco Pizarro founded Trujillo in 1535, and it was long an important place commercially. Near by are the ruins of *Grand Chimu*,

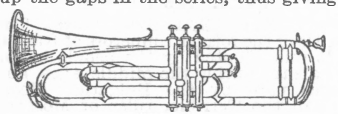
one of the largest Indian cities known. Pop. (1931), 30,000.

TRUJILLO (Rom. *Turgalium*). A town of western Spain, in the province of Caceres, on the Tozo. Cereals, wine, and fruit are produced in the adjacent country-side; leather is manufactured. Trujillo was the birthplace of Francesco Pizarro, and a palace of his building is still extant. Pop. 11,500.

TRUJILLO. A state and city of Venezuela. The state is western, and has a seaboard on the Gran Lago de Maracaibo; it is traversed by the Eastern Cordillera, and bounded on the east by the Cordillera Merida. Until 1899 it was known as Los Andes. Pop. 218,780. The city is state capital, and exports coffee and cereals. It was founded in 1559, and was one of the most beautiful cities of America prior to its devastation by filibusters in 1668. Pop. 12,415.

TRUMPER, Victor Thomas. Australian cricketer, born in Sydney, 2nd Nov., 1877; he was early noticed as a fine bat. He played for N.S. Wales, and later was chosen to play in the Test teams against England and South Africa, for which he made a series of centuries. He died 28th June, 1915.

TRUMPET. The natural trumpet is confined to the notes of the harmonic series, and it is only in comparatively recent times that a reliable means has been discovered for filling up the gaps in the series, thus giving



Trumpet

the trumpet an unbroken chromatic scale of over two octaves. This is achieved by means of three valves worked by pistons, which when depressed add to the vibrating length of the instrument by introducing into it certain pieces of tubing. The first piston lowers the pitch two semitones; the second, one semitone; and the third, three semitones.

As the pistons can be used in combination, they provide a means of lowering the pitch of the natural instrument from one to six semitones. The valves thus perform the same function as the slide of a trombone (q.v.). The trumpet forms the soprano to the trombone group.

TRUMPETER (Psophia). A genus of wading birds, family Psophidæ, of the crane order (Gruiformes), found in tropical South America, and so named from their hollow cry. The most familiar species is the Agami or golden-breasted trumpeter (*P. crepitans*), a bird of the size of a pheasant, which is readily tamed.

Agami or Golden-breasted Trumpeter

TRURO. An episcopal city, port, and municipal borough of Cornwall, England, at the confluence of the Kenwyn and Allen. The principal building is the new cathedral of St. Mary (the first Protestant cathedral, except St. Paul's, built in England), consecrated in 1887, Truro being established as a bishopric in 1876. It is one of the chief ecclesiastical structures of England. The city is built mainly of granite, and is engaged in the tin trade. There are tin-smelting works and potteries, and boots, clothing, and preserves are made. The harbour is dry at ebb-tide, and only vessels of 100 tons can make it. Pop. (1931), 11,074.

TRUSTEE. In law, a person to whom property is legally committed for the benefit of some other party or parties, or for some special purpose. No one is compelled to undertake a trust, but if he once accept he cannot renounce it unless the trust deed contains a provision enabling him to do so, or a competent court grants him a discharge, or he obtains the consent of all those beneficially interested in the estate, provided they have attained the age of 21; or he declares by deed that he is desirous of being discharged, there remaining at least two individuals or a trust corporation and his co-trustees and any person

having by deed consented to his retirement.

Trustees are liable for the consequences of any breach of trust, however innocent, and the estate of a trustee deceased who has misapplied the trust funds is liable for the deficiency; but generally speaking, the law requires of a trustee only the same amount of care and prudence as he would be expected to display in managing his own affairs, and the court may relieve a trustee from personal liability for any breach of trust if he has acted honestly and reasonably, and ought fairly to be excused.

In general, a trustee cannot escape responsibility by leaving to another person, even a co-trustee, the performance of his duties, and when there are several trustees one of them cannot safely leave the property in the sole possession or control of another of them. The law, however (which is largely consolidated in the Trustee Act, 1925), does permit a trustee to delegate his duties in certain circumstances.

Trustees are not entitled to any allowances for trouble in connection with the trust, unless specially authorised. "Trustee securities" include Government stock, stock of the Bank of England, debenture, preference, or guaranteed stock of railways, stock of municipal corporations, and generally on satisfactory real security.

TRUSTS. The name applied by business men and economists to all combinations of capital in industry which restricts competition. In the United States combinations of this kind originally took the form of actual trusts, all the shareholders in a number of competing firms placing their shares in the hands of a small committee of trustees, who are thus given absolute powers over the direction of the whole concern. This device, however, was declared illegal by the American courts, and has been replaced by others to which the name of trusts has clung.

A Committee appointed by the British Ministry of Reconstruction in Feb., 1918, "To consider and report what action, if any, may be necessary, in view of the probable extension and development of Trade Organisations and Combinations, to safeguard the public interest," reported that "there is at the present time in every important branch of industry in the United Kingdom an increasing tendency to the formation of Trade Associations and Combinations, having for their purpose the restriction of competition and the control of prices."

These associations and combinations vary very greatly in size, in form, in strength, in the extent to which they limit the freedom of the individual firms within them, and in the degree to which they constitute monopolies, with power to control output and regulate prices. The simplest form of understanding may be illustrated by the periodical meetings of coal merchants to discuss the prices to be charged by all. At the other end of the scale are such consolidations as those of Messrs. Coats, Ltd., with a capital of £10,000,000, and the United States Steel Corporation, with a capital of £369,000,000.

In Great Britain there are at the present time no statues in force affecting combinations, beyond those provisions of the Companies Acts which enforce a measure of publicity with regard to the organisation of all limited liability companies and their methods of management. Combinations operating in restraint of trade, however, though they are not criminal, are unlawful, if shown to be against public policy.

In the United States and the British Dominions somewhat drastic legislation has been passed by which almost every form of trust is rendered illegal; but, in practice, these statutes have had practically no effect upon the trend of industrial development.—BIBLIOGRAPHY: Hilton, *Memorandum on Combines and Trade Organisations*; Jenks and Clark, *The Trust Problem*; Marshall, *Industry and Trade*.

TRUTNOV. *See* TRAUTENAU.

TSAR, or CZAR (Lat. *Cæsar*). The title of the former Emperors of Russia. It was adopted by the people in the Balkans during the Middle Ages, and was used by the Bulgarian kings. Ivan the Terrible, ruler of Moscow, was the first to be crowned Tsar (1547). Peter I. assumed, however, the title Emperor (*Imperator*) (1724). The wife of the Tsar was named *Tsaritsa* and his son the *Tsarevitch*. *See* RUSSIA.

TSARITSYN, now **STALINGRAD.** A town of Soviet Russia, on the Volga, 40 miles from Kalach (on the Don); served by rail from Griazi and Nikolskaya (both on the Moscow-Rostov trunk line), and to Kalach. Before the Russian Revolution Tsaritsyn was, after Nijni-Novgorod, the chief Volga port and a great transport centre, with a turnover in 1909 of 1,656,000 tons. Transhipments from river to rail and vice versa formed a large part of the everyday commercial life of the town.

In addition it is a banking centre; the usual centre for timber sales; the distributing centre for the Lower

Volga-Don fisheries (stellated sturgeon, sterlet, roach, perch-pike, pike, bream, carp, lamprey, and Caspian herring, etc.); a market for tallow, oils, and animal fats; a distributing centre for wool, oil-seeds, cereals, fruit, salt, and cattle; and a storage-place for petroleum in transit from the Caspian to northern or western destinations. Pop. (1926), 294,500.

The Volga flows to the Caspian and the Don to the Black Sea. There is no canal connection between the two rivers, and a Volga-Don canal would give the former river a traffic exit to Europe and the world, instead of to an inland lake. Some high ground intervenes between the two towns, but much greater difficulties have been surmounted elsewhere. A railway line connects Tsaritsyn (direct) with Novorossiisk on the Black Sea, via Tikhoretskaya on the Vladikavkaz Railway.

TSARSKOE-SELO, or **TSARSKOYE-SELO** (*Tsar's Town*). A town of Soviet Russia, in the former government of Leningrad; connected by rail with Pavlovsk and Leningrad by the earliest line constructed in Russia (1838). As the Finnish village of Saari-mois (Russ. *Sarskaya*), the site was given by Peter the Great to his wife Catherine, and the name was changed to Tsarskoe-Selo. In recent times it comprised a town and German colony, which were summer-resorts of the people of Leningrad; and the palaces and parks of the Tsars. It is now nationalised and called **Detskoe-Selo** (Children's Settlement).

TSCHAIKOVSKY, or **TCHAIKOVSKY, Peter Ilich.** Russian composer, born in 1840 at Kamsko-Votinsk, died at Petrograd in 1893. He studied under Rubenstein at the Petrograd Conservatorium of Music. For many years he taught, first privately, and from 1866 as Professor of Harmony, at Moscow, but from 1877 Tschaikovsky devoted his time entirely to composition. In 1888 he began a series of tours as conductor of his own works, making in that year his first appearance in London. In 1893 he received from Cambridge University the degree of Doctor of Music, *honoris causa*, in company with Boïto, Saint-Saëns, Max Bruch, and Grieg.

Tschaikovsky's great popularity may be accounted for by the sensuous quality of his music, its strong emotional appeal and wide range of expression. His symphonies and symphonic poems are among his finest works, showing his gifts as a melodist, harmonist, and master of a rich and glowing orchestration. His writings include operas, concertos, chamber music, songs, and solos for pianoforte. Among his operas are *Eugen Onegin* (1879) and *Iolanthe* (1893); his best-known symphony the *Pathétique*.

TSETSE-FLY. The name of stoutly built two-winged flies native to tropical Africa, and belonging to the genus Glossina. Some of them cause fatal diseases in man and various mammals by introducing protozoan parasites (trypanosomes) into the blood. *G. palpalis* and *G. morsitans*, for example, are responsible for nagana or fly-disease in horses, cattle, camels, buffaloes, and antelopes, the parasites being *Trypanosoma brucei* and *T. congolense*. Sleeping sickness in human beings is set up by *T. gambiense*, disseminated by *Glossina palpalis*.

TSINGTAO. The port and administrative centre of Kiaochow (q.v.), China. On 10th Dec., 1922, the Chinese flag was raised over the administration building for the first time in twenty-four years, and Wang Cheng-ting, the Chinese Foreign Minister, accepted the territory of Kiaochow from the Japanese. Pop. (1931), 390,337.

TSU. A town of Honshiu, Japan, on Ise Bay; served by rail to Kyoto. It has manufactures of textiles and fancy wares. Pop. 47,741.

TSURUGA. A seaport-town of Honshiu, Japan, on an arm of Nakasa Bay; served by rail to Kyoto. It has manufactures of textiles, and has regular steamship connection with ports of the Far Eastern Republic. There are shipbuilding-yards. Pop. 20,000.

TSUSHIMA. A Japanese island lying between Korea and Kiushiu, about 50 miles from the Korean coast. Izuhara is the chief town. During the Russo-Japanese War a great naval engagement was fought on 27th and 28th May, 1905, in which the Japanese under Togo outmanœuvred and decisively defeated an equal number of Russian capital ships (12) under Rohzdestvensky. This battle is called Tsushima. Area of island, 274 sq. miles; pop. 42,000.

TUAM. An episcopal city of Galway, Irish Free State. It is the seat of the Protestant Bishop of Tuam, and also of the Roman Catholic archbishop. Its principal edifices are the Protestant and Roman Catholic Cathedrals and the college of St. Jarlath. Pop. 5988.

TUAPSE. A North Caucasian port on the Black Sea; a terminal of the Armavir-Tuapse Railway, which starts from Armavir Junction on

the Vladikavkaz Railway and runs through the Maikop oil-fields. It was opened in 1914, and completed in 1916. Tuapse roadstead is protected by two moles, and a safe harbour was completed about 1915. Pop. 20,000.

TUAREG, or **TAWAREK.** The autochthonous Berber (Hamitic) peoples of the West-Central Sahara who were supplanted by Arab (Semitic) conquerors of North Africa during the eleventh century, and adopted thereafter a nomadic life. Among themselves they are known as *Imoshagh,* and their language as *Tamashek,* the purest dialectical survival of the ancient Berber tongue.

The Tuareg occupy over 1,000,000 sq. miles of territory, and number (at a guess) 400,000 souls. There are four main tribes: (1) the Azjer of Ghadames and Ghat; (2) the Kelui of Air; (3) the Ahaggar tribe; and (4) the Awellimiden of the Timbuktu region. The Malekite sect of Sunnite Mahommedanism is nominally the chief religious denomination.

To the Arabs the Tuareg are "the Veiled People," from their *litham* or veil, which in the case of nobles is blue, white being the colour of the *Imghad* (hereditary serfs) and the slaves. The *litham* acts as a protection against wind-blown sand, but in course of time it has acquired a religious significance, and is never removed in public. From the two colours the terms "black" and "white" Tuareg are derived.

TUBERCULOSIS. An infective disease caused by the *bacillus tuberculosis,* an organism a little more than three-thousandths of a millimetre (3·5μ) long, demonstrated by Koch in 1882. The typical reaction to which the bacilli give rise is a chronic inflammation characterised by the development of the nodular *tubercles,* which give the disease its name. Such nodules are in reality minute battle-grounds between the infective organism and the surrounding body tissue, which, owing to the often inadequate reaction of that tissue, tend to increase in size, to coalesce, and later to undergo secondary changes, the formation of areas of dead tissue, caseous in character, and subsequent softening, calcification, or change into fibrous material.

Infection may take place by hereditary transmission, exceedingly rare in man; by inoculation, which occurs occasionally among pathologists, other medical workers, and among butchers; by inhalation, which must be less frequently a source of infection than is commonly supposed; and by ingestion. Von Behring has gone so far as to assert that adult phthisis is always due to infection through the intestinal wall early in life; but this view is extreme.

From the skin to the brain there is no tissue of the human body exempt from infection by the bacillus, the commoner sites being the lung, bones, and joints, notably the hip-joint and the spine, the intestine and the lining membrane of the abdomen, the membranes of the brain, the kidney, and urinary bladder, and the lymphatic glands of the neck.

Tuberculosis, the most widely distributed of the diseases fatal to man, is responsible for one in ten of all deaths in Great Britain. Cures increase in number with the advance of medical science, and to an even greater extent prevention steadily decreases the mortality. Sunlight and proper feeding are still, in spite of bacteriological advances, the most effective means of combating the disease. *See* CONSUMPTION.

TUBEROSE (*Polianthes tuberōsa*). A plant of the nat. ord. Liliaceæ, originally brought from the East, and now largely cultivated under glass in Europe both for its perfume and for its beautiful white flowers. It has a bulbous root, and an upright branchless stem growing to the height of 3 or 4 feet. It is cultivated for the perfumers in France and Italy.

TÜBINGEN (tü'bing-in). A town of Württemberg, Germany, on the Neckar. Manufactures include chemicals. The university was founded in 1477, and has a library of over 300,000 vols. Reuchlin and Melanchthon were professors there, as was also F. C. Baur (founder of the Tübingen school of theology) (q.v.). Tübingen is a junction on the Plochlingen-Villingen line for Sigmaringen and Herrenberg (pop. 3000). Pop. (1925), 20,276.

TUBIP'ORA. A genus of corals belonging to the sub-class Alcyonaria, and represented by the familiar scarlet organ-pipe coral (*T. musica*), and by other species.

TUBUAI, or **AUSTRAL, ISLANDS.** A French atoll group in the Pacific Ocean, south of the Society Islands. Copra, bananas, arrowroot, and some sponges are produced. Area 115 sq. miles; pop. 1389.

TUCSON. A city of Arizona, United States, the county seat of Pima county, on Santa Cruz River; served by the Southern Pacific Railway. It is an educational centre, and has the University of Arizona. There are railway headquarters (divisional) and repair-shops, and the city is the centre of a rich irrigated agricultural region. The winter climate is mild

and attracts many visitors. Tucson was taken over by the United States in 1856, and became a city in 1883. Pop. 32,506.

TUCUMÁN'. A north-central province of Argentina. It falls from the Sierra de Aconquija in the west to a rich flat plain in the east, and is drained by the Dulce (Sali) and its many affluents. The valleys of the Sierra are afforested and much worked for timber; the latter produce cereals and fruit. Cattle are raised; leather, hides, skins, sugar, cheese, and *aguardiente* (a distilled alcoholic beverage resembling brandy) are exported. Tucumán is the capital. Area, 8817 sq. miles; pop. (1932), 461,042 (the smallest and most densely populated province of Argentina).

TUCUMÁN, or **SAN MIGUEL DE TUCUMÁN.** A city of Argentina, capital of the province of Tucumán, on the Dulce (Sali); a prominent railway junction. Alcohol, beer, and sugar are made; the environs have numerous orange-groves and sugar-plantations, which flourish in a mean annual temperature of 68° F. (approximately). Agues and fevers of malarial type are fairly prevalent. Tucumán was founded by Villaruel in 1564, and supplanted Santiago del Estero in 1680 as capital of the Spanish province of Tucumán. The conference which proclaimed the independence of the La Plata provinces met at Tucumán in 1816. Pop. (1930), 123,572.

TUDELA (Rom. *Tutela*). A city of Spain, in the province of Navarre, on the Ebro; served by the Saragossa-Alsasua Railway, and by a line to Tarazona (ancient *Turiaso*, the seat of a bishop; pop. 9000). Sawmilling, and the manufacture of cloth, liquor, dried fruit, etc., are the chief occupations. Tudela was in Moorish hands for over three centuries before its surrender in 1114 to Alfonso I. of Aragon. Pop. 9500.

TUDOR STYLE. In architecture, a name frequently applied to the Gothic style in England, being the last phase of the perpendicular, and sometimes known as *Florid Gothic*.

The period of this style is from 1400 to 1537; but the term is sometimes extended so as to include the Elizabethan period also, which brings it down to 1603. It is the result of a combination of the Italian style with the Gothic. It is characterised by a flat arch, shallow mouldings, and a profusion of panelling on the walls.

TUESDAY. The third day of our week, so called from the Anglo-Saxon god of war, *Tiw*. It was called *Dies Martis* (day of Mars) by the Romans, whence the French *mardi*.

TUGELA (tu-ga'la). A river of Natal, rising in the Drakensberg Mountains, and flowing to the Indian Ocean 50 miles north of Durban; length, 300 miles. Several places on or near it, notably Colenso, came into prominence during the South African War.

TUILERIES (twēl-rēz; from Fr. *tuile*, a tile, because the spot on which it was built was formerly used for the manufacture of tiles). A former royal palace in Paris, on the right bank of the Seine. Catherine de' Medici, wife of Henry II., began the building (1564); Henry IV. extended it, and founded the old gallery (1600), and Louis XIV. enlarged it (1654), and completed that gallery. The side towards the Louvre consisted of five pavilions and four ranges of buildings; the other side had only three pavilions.

Napoleon I. resided in the pavilion of Flora, as did afterwards Louis XVIII. and his successors. During the Revolution of 1830 the palace was sacked. It was restored by Louis Philippe to its former splendour, but in 1848 it was again pillaged. The Tuileries then became a hospital for wounded, a picture-gallery, and the home of Louis Napoleon in 1851. On 23rd May, 1871, it was almost totally destroyed by fire (the work of the communards), and the remaining portions were removed in the year 1883.

Tudor Style. Compton Wyniates, Warwickshire, 1525

TULA. A province of the Russian S.F.S.R.; area, 11,960 sq. miles. The surface is generally flat, and the principal rivers are the Oka, the Upa, and the Don. Much grain is produced, and vast numbers of horses, cattle,

and sheep are reared. Iron is smelted and manufactured to a large extent. Pop. 1,830,000.

TULA. A town of Russia, capital of the province of Tula, on the Upa; served by rail from Moscow. It is semi-industrial, manufacturing rifles mainly, but also cutlery, soap, candles, cordage, leather, and tea-infusing urns (*samovars*). Pop. (1926), 150,132.

TULCEA. A town and port of Rumania, in the Dobruja, capital of the department of Tulcea, on the St. George arm of the Danube; the northern terminal of the trans-Dobrujan Railway to Dobrici, via Babadag and Megidia. It is an important fish-market, with a bank and a grain trade. Pop. 20,108. The department is one of the best agricultural regions of the Dobruja. It lies outside of the Danube delta, and includes the oak- and beech-wooded hills and the many streams of the Babadag Plateau. Copper and copper pyrites are found, and hematite iron is said to exist. Area of department, 3330 sq. miles; pop. about 190,000.

TULIP. A genus of plants (Tulipa), nat. ord. Liliaceæ. The species are bulbous herbaceous plants, inhabiting the warmer parts of Europe and Asia Minor, and are now extensively cultivated in gardens. About forty species have been described, of which the most noted is the common garden tulip (*T. gesneriana*), a native of the Levant, and introduced into England about 1577. Upwards of 1000 varieties of this plant have been enumerated.

The wild tulip (*T. sylvestris*), a doubtful native of Britain, has yellow flowers, and blooms in April and May. The sweet-scented tulip (*T. sauveölens*) is much prized for its fragrance. About the middle of the seventeenth century an extraordinary tulip mania prevailed in Holland. Enormous sums were given for bulbs, the ownership of a bulb being often divided into shares, in which men speculated as they do in ordinary stocks or shares.

TULIP TREE. An American tree bearing flowers resembling the tulip, the *Liriodenendron tulipifera*, nat. ord. Magnoliaceæ. It is one of the most magnificent of the forest trees in the temperate parts of North America. Throughout the United States it is generally known by the name of poplar, white wood, or canoe-wood. The wood is light, compact, and fine-grained, and is employed for various useful purposes.

TULLAMORE. An urban district and market town of Offaly, Leinster, Irish Free State, the county town, on the Clodiagh River. There are two breweries, a large distillery, aerated mineral-water works, etc. Pop. (1926), 4924.

TULLE (tül). A city of France, capital of the department of Corrèze, on the Corrèze. It has a cathedral and episcopal palace, a communal college, a diocesan seminary, etc., and manufactures fire-arms (a State industry), drugget, wax-candles, playing-cards, leather, etc. It is on the Brive-Ussel and Uzerche-Argentat railways. Pop. 16,942.

TULLOCH, John. Scottish theologian, born 1823, died 1886. Educated at St. Andrews and Edinburgh Universities, he was appointed (1854) principal of St. Mary's College, St. Andrews, a position which he held until his death. Tulloch was an influential leader in the councils of the Scottish Church, and the author of the Burnet prize essay on *Theism* (1855), *Pascal* (1878), *Facts of Religion and Life* (1877), besides many articles in the reviews. He had a share in founding *The Contemporary Review*, and was the last editor of *Fraser's Magazine*.

TULLUS HOSTILIUS. According to the legend, third King of Rome and successor to Numa Pompilius (670-638 B.C.), a warlike monarch, in whose reign took place the combat of the Horatii and Curiatii.

TULSA. A city of Oklahoma, United States, the county seat of Tulsa county, on the Arkansas River; served by the Atchison, Topeka, & Santa Fé, and other railways. Natural gas is found in the vicinity, and is used for power; glass and cotton-seed oil are made. Settled in 1887, Tulsa became a city in 1902. Pop. (1930), 141,258 (the second largest city in the state).

TUMBES. The northernmost province of Peru, South America, contiguous to Ecuador. Tumbes, a port on a river of the same name, is the capital (pop. 6000), and is the place where Pizarro landed in 1527. Area (province), 1590 sq. miles; pop. 12,000.

TUMMEL. A river of Perthshire, Scotland, rising from Loch Rannoch, and forming Loch Tummel about half-way to its confluence with the Tay below Logierait. In its valley is found the most picturesque of Scottish scenery; length, 40 miles.

There is a complete system traceable from Stob Ghabhar (3565 feet altitude), where the river rises as the Bà, expands into Loch Bà, and empties into Loch Laidon by the Abhainn Bà. Laidon is emptied by the Gearr Ghaoir into Loch Eigheach,

whence the waters are carried to Loch Rannoch by the Abhain Gaoire.

TUMOUR. In surgery, in its widest sense, a morbid enlargement or swelling of any part of the body or of any kind; more strictly, however, it implies a permanent swelling occasioned by a new growth, and not a mere enlargement of a natural part, which is called hypertrophy. Tumours may be divided into two well-defined classes:

(*a*) **Simple, benign, or innocent tumours,** the substance of which has anatomical resemblance to some tissues of the body; they gradually increase in size, and generally only produce inconvenience from the great bulk they sometimes attain; a complete cure may be effected by simple excision.

(*b*) **Malignant tumours,** which bear no resemblance in substance to normal tissue; they are exceedingly liable to ulceration, they invade all the textures of the part in which they occur, affect the mass of the blood, and may terminate fatally; when excised they are apt to recur not only in the immediate neighbourhood of the previous site, but also in remote parts of the body. Of the malignant class cancer is a well-known example. *See* CANCER.

TUNBRIDGE WELLS, ROYAL. A municipal borough and watering-place of Kent, England. Incorporated in 1889, it has been called Royal since 1909. It has a spacious parade, Pump Room for visitors taking the waters, and Convalescent Home for Children. Manufactures include toys and fancy articles. It is one of England's most fashionable inland spas, and is much frequented in August and September. The chalybeate springs were discovered in 1606. Pop. (1931), 35,367.

TUNDRAS. A term applied by physical geographers to the immense stretches of flat, treeless country extending along the arctic coastal regions of Eurasia and America. They are frozen the greater part of the year, but in summer thaw out into vast mosquito-infested prairies and swamps. The inhabitants are Samoyeds, Ostyaks, Yakuts, Finns and Lapps (all Eurasia), and Eskimos and Indians (North America).

TUNGSTEN. A metal discovered in 1781; atomic weight, 184; symbol, W (from its other name *wolfram*). It has a greyish-white colour and considerable lustre. It is nearly as hard as steel, and less fusible than manganese. The ores of this metal are the native tungstate of lime and the tungstate of iron and manganese, also known by the name of *wolfram*. By suitable operations the metal may be drawn into wire, which is largely used in the manufacture of electric-light bulbs (*see* ELECTRIC LIGHT). Tungsten is also much used in the manufacture of self-hardening and high-speed tool steels.

TUNGURAHUA, or TUNGURAGUA. A central province and mountain of Ecuador, South America. The province comprises the Ambato basin (average, 8000 feet altitude), one of the three plains into which the high plateau (300 miles long) between the two Cordilleras is divided. This is largely an arid waste; but the eastern slopes of the Cordillera Occidental are also within the province, which is named after the quiescent volcano Tungurahua (16,690 feet), famous for its cataract and lava stream.

At the foot of Tungurahua are the thermal springs of Baños (5900 feet altitude). On the western border lie Chimborazo and Carahuairazo (16,515 feet). The latter is known in Ecuador as Chimborazo's Wife. Ambato (altitude, 8435 feet; pop, 1932, 16,600), the capital, is on the railway to Curaray (182 kilometres), via Pelileo (34 kilometres). Area of province, 1685 sq. miles; pop. (1931), 180,000.

TUNGUS. A Turanian people occupying a vast territory of Eastern Asia (*see* map under TURANIAN). They are nomads and huntsmen, and number about 76,000. Apart from the Tungus proper, the Manchus of Manchuria form the principal division of the Tungus generally, and they number in round figures 1,000,000 souls. There are no Tungus towns and no houses, tents only being used. Shamanism is the chief religion, although there is, here and there, a thin veneer of Christianity, and Buddhism has, through Chinese influence, become prevalent among the southern groups. Physically, the Tungus are Mongolian and of low stature (about 5 feet 4 inches).

The Tungus language forms a branch of the Turanian or Ural-Altaic family, and among its dialects Manchu is outstanding, for the Manchus are not only the chief Tungus people, they also form the only division with a history. Their dialect is still characterised by the Turanian vowel harmony; and, with the passing of the ages, as the language of the former ruling caste of China it has developed a considerable literature.

TUNICA'TA. A class of animals constituting the degenerate sub-phylum Urochorda of vertebrates. A simple tunicate is enveloped in a leathery mantle, with two orifices, one oral and the other anal, and covering the body-wall, to which it adheres at the

orifices. These animals are popularly named *sea-squirts*, and are found either solitary or in groups, fixed or floating. *See* ASCIDIA.

TUNIS. The capital of the French protectorate of the Regency of Tunisia. It stands on a narrow isthmus which separates the salt lake Sebkha es-Sedjoumi from El-Bahira, or the Lake of Tunis, and is connected with the Bay of Tunis and the Mediterranean by a ship-canal opened in 1893. There is a native town, a typical Arab city with attractive *sugs* (bazaars); but the administrative and other European offices and businesses are located in the Quartier Franc, a new French city fringing the shores of the Bahira. Pop. (1931), 202,405, of whom 89,801 are Moslems, 46,457 Italians, 33,649 French, 25,399 Jews, and 5529 Maltese. *See* TUNISIA (*Climate* section).

The ship-canal, some 7 miles in length, made Tunis a seaport, and practically terminated the prosperity of Goletta, which up to 1893 had been its port. Goletta is built on the storm beach which encloses the Bahira, and is at the seaward end of the canal, along the right bank of which it is connected by tramway with Tunis. There is still at Goletta a large dock, about 100 feet long by 500 feet in breadth, which is connected with the canal by the Goletta (Ar. *Halk el-Wad*, throat of the river, i.e. gullet, of which an obsolete English variant is *golette*). The French name is La Goulette. Goletta is quite near the ruins, majestic even in decay, which mark the site of ancient Carthage. There is a fort and battery and an arsenal. Pop. of Goletta, about 6000. North of the town, about 5 miles distant, is El-Marsa, a sea-bathing resort and villa-town.

TUNISIA. A regency of North Africa, extending along the Gulf of Qabes (Gabès; ancient *Syrtis Minor*) and the Mediterranean, and forming a protectorate of France. The name of the country in Arabic is *Ifriqiyah*, an archaic Berber form of which (*Ifrigia*) was latinised as *Africa* by the Romans; and so Tunisia of to-day was the original Africa of classical times, and from the designation of a puny state the name rapidly extended, replaced that of *Libya*, and became the customary title of the entire continent.

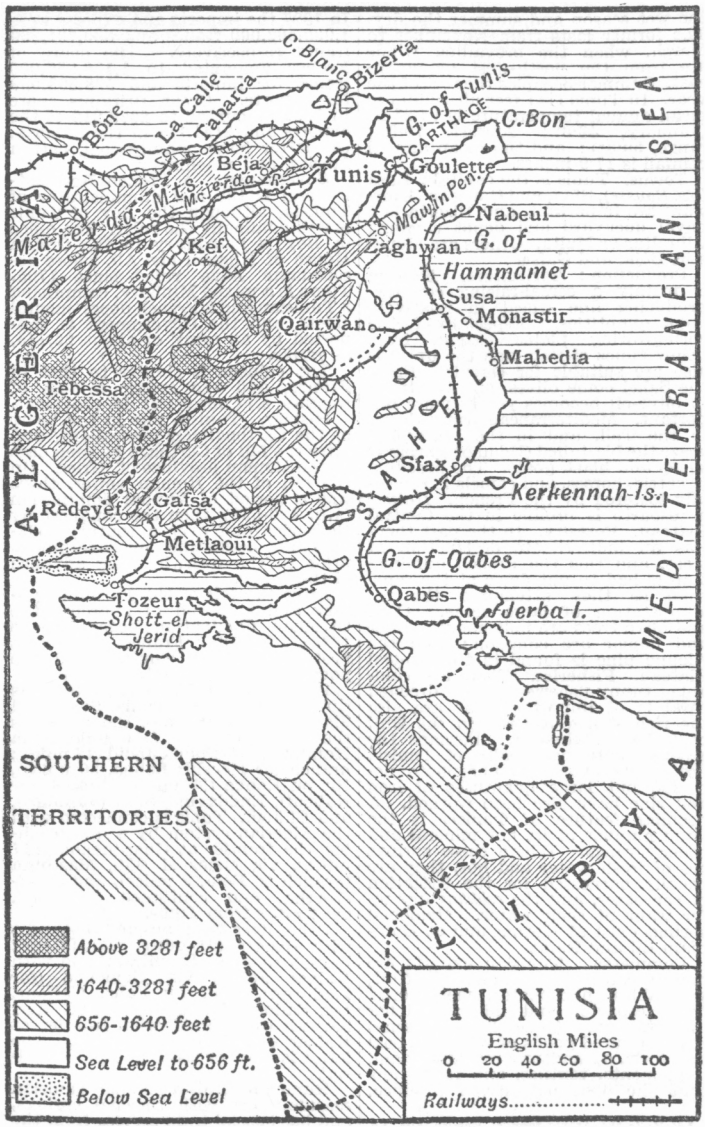
Modern Tunisia is bounded by Algeria, the Sahara, Tripolitania, and the Mediterranean, and occupies an area of 48,300 sq. miles, with a pop. (1931) of 2,215,399 non-Europeans and 195,293 Europeans. The majority of the native Arabic-speaking population are Moslem Berbers, who number (1931) 2,159,151, the remainder (56,242) being Jews. Among Europeans are 91,427 French, 91,178 Italians, and 8643 Maltese.

Physical. Tunisia consists of four distinct physical regions, namely, Tell, Sahel, Central Plateau, and Sahara. The Tell is a mountainous, wooded, and well-watered continuation of the Algerian Tell, tucked away in the north-west corner of the protectorate. The heights are interposed between the sea and the valley of the Majerda, the only large perennial stream in Tunisia. It is the *Magarath* of the Carthaginians and the *Bagradas* of the Romans, and has its main source in the Majerda Mountains (Monts de la Mejerda) in Algeria, falling into the sea on the north coast after a course of 300 miles.

The drainage area is 10,000 sq. miles. It is a notable fact that, in the course of centuries, the deltaic fan of the Majerda has extended to fill up the ancient lagoon of Utica, upon which at one time stood the majestic Tyrian city of Utica (q.v.). The Sahel region is the coastal plain, varying between 30 and 60 miles broad, which extends in a northerly direction from the *Jefara* of Tripolitania to Cape Bon (*Ras Adder*; ancient *Hermæum Promontorium*). In Algeria the Atlas [1] becomes a wide central plateau, and this extends into Tunisia between the Majerda Valley on the north and the Sahara region on the south, with an average altitude of 2000 feet. It is arid in parts. The Tunisian Sahara occupies the whole of the south, and is traversed by the so-called Matmata Plateau, a dissected table-land rich in vegetation and rising to an average altitude of 3000 feet.

Climate. Tunisia is normally healthy, but climatic conditions are variable. In the Sahara rain may not fall for years, but the Tell, which has developed as a health-resort, has a good rainfall all the year round. On the Sahel there are two seasons, winter and summer, winter being

[1] See physical section of *Morocco*. Tunisia has about 200 miles of the Atlas system which is clearly a physical entity although not one single and complete mountain range. For the whole of its length from Morocco to the Gulf of Qabes the Atlas is backed by a depression separating the mountains from the vast Ethiopian Plateau, just as the Indo-Gangetic plain or depression separates the Himálaya from the high plateau of the Indian Peninsula. In Tunisia the Shott el-Jerid (some 60 feet altitude) and other *sebkhas* (all below sea-level) occupy the depression. Sir Harry Johnston has pointed out that the *Shotts* of the French is a misnomer for Ar. *Shat*, an estuary or lake. An estuary or arm of the sea unquestionably occupied this *sebkha* region recently in geological time, unless it is due to volcanic action, but now there remain only mud-flats, which in the dry season are hard-caked and coated with a deposit of salt.


C. Blanc
Bizerta
Bône
La Calle
Tabarca
G. of Tunis
CARTHAGE
C. Bon
Béja
Medjerda R.
Tunis
Goulette
Mauln Pen.
Nabeul
Kef
Zaghwan
G. of Hammamet
Susa
Monastir
Qairwan
Mahedia
Tebessa
Sfax
Kerkennah Is.
Redeyef
Gafsa
Metlaoui
G. of Qabes
Qabes
Jerba I.
Tozeur
Shott el Jerid
SOUTHERN TERRITORIES
ALGERIA
MEDITERRANEAN SEA
LIBYA
Above 3281 feet
1640-3281 feet
656-1640 feet
Sea Level to 656 ft.
Below Sea Level
TUNISIA
English Miles
0 20 40 60 80 100
Railways

the wet season and summer the dry. The former lasts from November to March, when the prevailing winds are from the north-west or north-east. Summer occupies the rest of the year. In Tunis (141 feet altitude) the mean annual temperature is 64·2° F. (January, 49·6°; August, 79·9°; range, 30·3°); and the mean annual rainfall is 17·9 inches.

Towns. Tunis is the capital; Susa (Fr. *Sousse*), Sfax, and Qairwan (Kairwan) are important, and Bizerta is a naval dockyard and depôt rivalling Gibraltar or Malta. Others are Monastir, Béja, and Gafsa.

Production: Agriculture. Tunisia is mainly a cereal-raising country, producing fine wheat in relatively large quantities. Especially fertile corn-growing plains extend from below Mejez el-Bâb, and the uplands also are suitable for cereals. From the Sahel come olives, and the trade in olive-oil becomes yearly more important. Mediterranean fruits thrive in the Tell, and in the hinterland graze the big-tailed (Udad or Barbary) sheep and black goats. The breeding of cattle, horses, and camels is especially fostered by the French. *Halfa* [2] or esparto is prolific in the Central Plateau. **Forestry.** In the past there was an indiscrimate destruction of trees, and this the French administrators had to put down at the same time as they attempted the re-afforestation of large areas. Cork and olive trees are indigenous; alder and poplar are common; and the Aleppo pine is found in the Central Plateau. **Fisheries.** There are valuable tunny-fisheries, and dredged coral is of importance, as are also the rich sponge-fisheries in the Gulf of Qabes. **Minerals.** Perhaps the greatest potential wealth of Tunisia lies in its enormous phosphate deposits, but large quantities of iron and zinc have also been worked. A peculiar feature of Tunisia is the large number of its hot mineral and other springs. Where these springs are of fresh water and hot, they are usually harnessed for the irrigation of the oases, and the *sebkhas* dry up for want of their water. Medicinal springs exist at Korbus and at Hammam Lif and Gafsa.

Commerce. Tunisian exports are mainly cereals, wines, olive-oil, fruit, vegetables, phosphates, metal ores, *halfa* (esparto), and hides; and her imports are (generally speaking) manufactured goods of all kinds, coal and fuels, agricultural machinery and implements, textiles, and food-stuffs that she does not herself produce. In 1927 the imports and exports were 1,935,562,000 francs and 880,701,000 francs respectively. The share of France amounted to 1,136,986,000 francs for imports and 528,803,000 for exports. Great Britain's share in 1932 amounted to £673,215 of the exports and £194,111 of the imports, the latter being mainly coal, cotton fabrics, and machinery.

Government. A French Resident-General is the real administrator of Tunisia, although the Bey of Tunis is still nominally the ruler. The office of Bey is hereditary in the Cretan House of Hussein ben Ali, whose descendants have ruled since 1705. There is a mixed Ministry, comprising 3 Tunisian and 8 French departmental chiefs, and the Government is supported by an army of about 26,145, all ranks.

The coinage is similar to that of France, and the metric system of weights and measures is prevalent.

History. Tunisia was in the heart of the Carthaginian possessions, and after the fall of Carthage became part of the Roman province of Africa. On the fall of the Roman power, there was a period of Vandal domination (A.D. 430-533), then the conquest by Belisarius and over a century (533-647) of Byzantine misgovernment prior to the overwhelming advance of the Arabs.

After the fall of the Fatimid dynasty and a period of anarchy, the Ottoman domination began (about 1575). In 1881 France declared a protectorate over Tunisia, and the power of the bey is only nominal.

Railways. The Tunisian system has three nodal points, Tunis, Susa, and Sfax. The backbone of the system is the Tunis-Sfax line (176 miles), via Hammam Lif, Fuduk Jedid (18 miles; branch for Henshir Lebna, 30 miles), Bir bu Rebka (37 miles; branch for Nabeul), Enfidaville, Susa (93 miles), and El Jem. Tunis is connected with the Algerian system by a line reaching the frontier at Ghardimaou (117 miles), via Mejez el Bâb, Mastouta (branch to Béja, 9 miles), and Souk-el-Arba, and continued to Bône, 220¼ miles from Tunis.

Other lines from the capital connect with Bizerta (61 miles, via Mateur; branch to Béja, 42 miles); and with Kalaat Jerda, via Depienne (for Zaghwan), Pont du Fahs, Gaffour, Les Salines (for Le Kef), and Wed Sarrath (for the Algerian frontier at Kalaat es Salaam, 18¾ miles). The latter is more or less a phosphate railway.

Hammam Lif is a popular Tunisian seaside-resort with thermal springs, and has special train service from the capital, 10 miles distant. Other main

[2] *Halfa* is the Arabic form of English Alfa, i.e. *Stipa Tenacissima*, or esparto grass (q.v.).

lines are: (1) Susa-Moknin-Mahedia, a short coastal line of 39 miles; (2) Susa-Kalâa Srira-Ain Ghrasesia (30 miles; for Qairwan), Sbeitla, Feriana, and Henshir Suatir, about 184 miles in all; and (3) Sfax-Redeyef, 177 miles, via Graiba (39 miles; for Qabes, 51 miles), Gafsa, and Metlaoui (151 miles; for Tozeur, 33 miles). The total railway mileage for 1931 was 1282 miles.—BIBLIOGRAPHY: Sir Harry Johnston, *The Colonization of Africa*; Douglas Sladen, *Carthage and Tunis*; Hesse-Wartegg, *Tunis: the Land and the People*.

TUNNEL. A subterranean passage, cut through a hill or under a river. The processes used in construction vary considerably. In one method a shield is used. This consists of a cylindrical steel shell with a cutting edge which is pressed into the head of the tunnel which is to be excavated. As the material is removed the whole shield is pressed forward by hydraulic jacks or rams. Steering to keep to the desired line and level is effected by the operation of some of the jacks to a greater extent than the others.

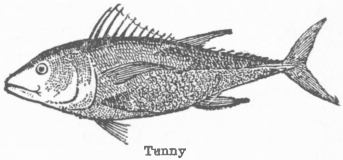
Rotary cutters of diameter suitable to the requirements of the finished tunnel, and driven by electric motors, are frequently used in cutting tunnels. They commonly are provided with a conveyer to lift the debris and carry it to a chute, through which it passes into wagons for removal.

In the making of river tunnels other methods have been adopted, such as building and sinking a series of caissons and afterwards connecting them up to form the tunnel. Occasionally a channel has been dredged across a river for a tunnel and suitable piles sunk across for its support. By the building of heavy timber sides and top a channel is left, which can be pumped out and kept clear by the use of compressed air, while the actual tunnel is constructed within the housing.

Tunnels must commonly be faced with material such as steel plates or rings with concrete in the space between them and the earth to maintain their form and to prevent the passage of water into them. Open-cut tunnelling is sometimes used, frequently in America, in the construction of underground railways. In this system a great channel is made and the tunnel constructed in it, and the ground afterwards made up.

TUNNY. A spiny-finned fish of the genus Thunnus and family Scombridæ, the *T. thynnus*, closely allied to the mackerel. These fish live in shoals in almost all the seas of the warmer and temperate parts of the earth. They are taken in immense quantities on the Mediterranean coasts, where the fishing is chiefly carried on. The flesh is delicate and somewhat resembles veal.

The common tunny attains a length of from 4 feet to even 20 feet, and sometimes exceeds half a ton in weight. Its colour is a dark blue on the upper parts, and silvery white below. The American tunny (*T. secundo-dorsālis*) is found on the



Tunny

American coast from New York to Nova Scotia. The albicore (*T. albicora*) and the bonito (*T. pelamys*) are allied species. Tunny oil is used in currying.

TUNSTALL. A town of Staffordshire, England, since 1910 part of the county borough of Stoke-on-Trent. Pottery and bricks are the chief manufactures; coal-mines and ironworks are located in the adjacent districts.

TU'PELO. *See* BLACK GUM.

TUPPER, Martin Farquhar. Minor poetaster, born in 1810, and died in 1889. He was educated at Charterhouse, and Christ Church, Oxford, and was called to the Bar, but never practised. His sole title to fame is his *Proverbial Philosophy*, which originally appeared in 1838; it was expanded into four series between 1839 and 1876. The earlier series went through almost sixty editions; a million copies were sold in America, and two hundred and fifty thousand in Great Britain. The author and the publisher made £10,000 a-piece.

The success of *Proverbial Philosophy* is one of the chief curiosities of Victorian literature. The public must bear its share of the blame; for the demand for work of this kind profoundly influenced the supply. The philosophy expounded in the books is commonplace to a ludicrous extent; the language is like the inverted speech of a foreigner; and the rhythm has broken free from the shackles of metre, and resembles many English attempts at writing hexameters.

Apart from his poetical effusions, Tupper was no fool. He invented safety horseshoes, glass screw-tops to bottles, and steam-vessels with the paddles inside. Of his forty literary works only one is remembered, and

its fame is due not a little to the brilliant parodies of "Cuthbert Bede" and Calverley, and caustic allusions of Gilbert :

"A fool is bent upon a twig, but wise men dread a bandit,"—
Which I know was very clever ; but I didn't understand it.

TURANIAN.[1] A term applied to all peoples of Turkic stock. They number some 48,000,000, of which 22,000,000 (Turks, Magyars, Finns) are in Europe, and the rest in Asia, and their languages are grouped together as the Ural-Altaic family (q.v.). There is no doubt that the Turanians are offshoots of a parent stock which inhabited, in proto-historic times, the steppes of Central Asia, especially the neighbourhood of the Altai-Sayan.

On the northern versant of the Altai, people of Samoyedic stock are found at the present day. Linguistically, there is less affinity among Turanians than among the five main branches of the Indo-European family.

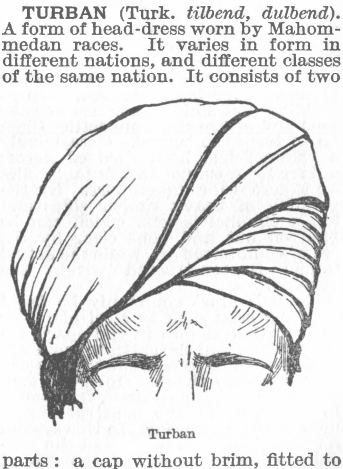
Physically, the ideal Turanian type is the Mongolian, which is probably almost typical of the parent stock. The chief characteristics are muscular build, medium height ; straight jet-black hair and scanty beard ; broad flat face with slanting eyes, and a broad flat nose ; low forehead, high cheekbones, and a yellowish-brown complexion.

It was the consciousness of their ethnological affinity with peoples under Russian and Chinese rule that aroused in the Osmanlis the ambitious idea of Pan-Turanianism. The Osmanlis themselves, with the Magyars and the Bulgars, by coming into contact with superior civilisations and by the infusion of Aryan blood, have almost, if not entirely, lost their physical characteristics as Turanians. The Finns have very nearly been absorbed by the Slavs (Russians).

It is worthy of note that none of the Turkic peoples have been able to emerge from their primitive state as nomads and Shamanists except those who have been associated with the Aryan peoples of the west. An exception to this general rule may be made in favour of the Manchus, probably the greatest of all the Turanian tribes. Many Manchus are Buddhists ; the Osmanlis are Moslems ; the Bulgars and Finns are more or less Christians ; and all the others are Shamanists.

In recent years the doctrine of Pan-Turanianism has been taken very seriously in some quarters, and it has even been considered as a new dogma. But it is not new. The struggle between Aryan and Turanian is a phase in the struggle for existence that has been carried on for close on 3000 years, and it was as active and as real in the time of Zoroaster as it is to-day. The main factor in Turanian propaganda is the Osmanli Turk, whose tribe has become a state with a more or less stable government, partially through the early adoption of Islam and of Arab culture, but more largely through a capacity for military training ; and although the Osmanli strain is not pure, for there is probably no purity of race in any nation, the congeries of racial types that forms the Turkish nation is held firmly together by the iron bonds of militarism.

TURBAN (Turk. *tilbend, dulbend*). A form of head-dress worn by Mahommedan races. It varies in form in different nations, and different classes of the same nation. It consists of two

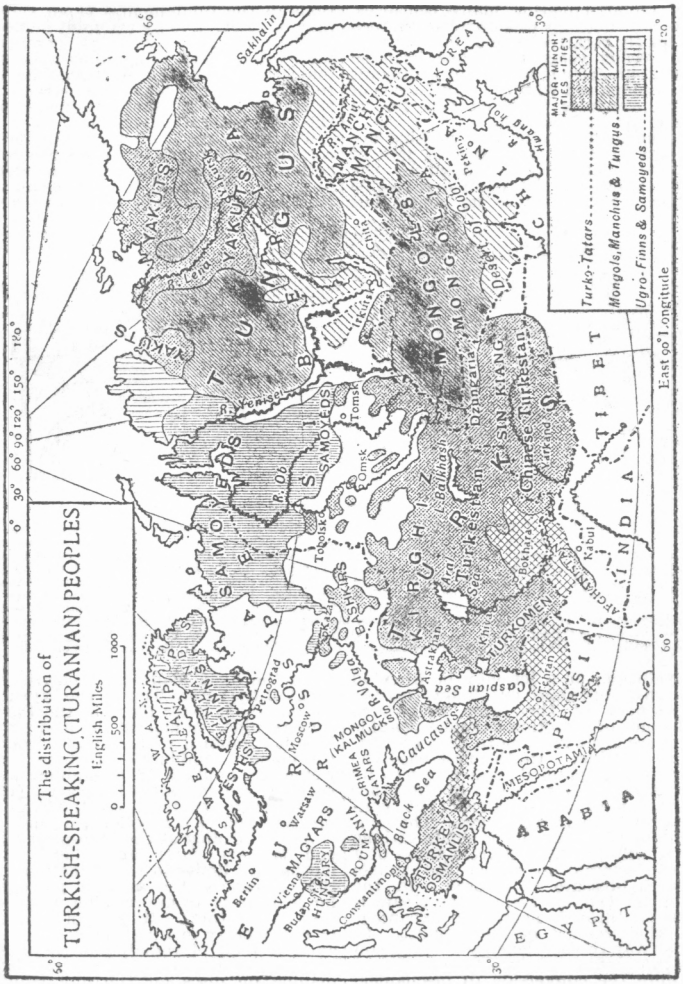


Turban

parts : a cap without brim, fitted to the head ; and a sash, scarf, or shawl, usually of cotton or linen, wound about the cap, and sometimes hanging down the neck.

TURBINE, STEAM. It is indeed strange that the steam turbine, which was the first type of prime mover to be invented, was the last to be com-

[1] The term *Turān*, from which the word Turanian is derived, was used in ancient Persian writings in contradistinction to *Irān* (i.e. Persia), and indicated the Trans-oxiana region. Firdusi in his *Shahnama* or *Book of Kings* (about A.D. 1000) uses *Turān* in this sense, but the word appears later as *Tura*, especially in the Zoroastrian *Avesta*. In the *Avesta* it is stated that the three sons of Thraetaona, the successor of Yima (= Noah), divided the earth just as did Shem, Ham, and Japhet in the Old Testament. These three sons were called Airya, Sairima, and Tūra respectively, and the former took Irān, the centre, and the latter Tūra, the east, the western region falling to Sairima. Irān is, of course, the modern form of the Middle Persian *Erān*, the land of the Airyana (i.e. Aryan). Tūrān or Turania was understood by the Persians as embracing the Central Asiatic region now known as Turkestan.


The distribution of
TURKISH-SPEAKING (TURANIAN) PEOPLES
English Miles
0
500
1000
MAJOR - MINOR CITIES - ITIES
Turko-Tatars
Mongols, Manchus & Tungus
Ugro-Finns & Samoyeds
East 90° Longitude
Sakhalin
KOREA
MANCHURIA
MANCHUS
CHINA
Pekin
Hwang ho
Desert of Gobi
MONGOLS
TUNGUSES
YAKUTS
Lena
Yenisei
Irtysh
Chita
Tomsk
Omsk
Tobolsk
SAMOYEDS
R. Ob
Dzungaria
SINKIANG
Chinese Turkestan
Yarkand
TIBET
INDIA
Kabul
AFGHANISTAN
Bokhara
Balkhash
Aral Sea
Turkestan
KIRGHIZ
TURKOMEN
Astrakhan
Caspian Sea
Teheran
PERSIA
MESOPOTAMIA
ARABIA
EGYPT
Caucasus
Black Sea
TURKEY
OSMANLIS
Constantinople
ROUMANIA
CRIMEA TATARS
MONGOLS (KALMUCKS)
R. Volga
Kazan
BASHKIRS
Petrograd
Moscow
Warsaw
Vienna
Budapest
HUNGARY
MAGYARS
Berlin
EUROPE
ESTHS
FINNS
LAPPS
NORWAY
SWEDEN
60°
30°
0°
30°
60°
90°
120°
150°
180°
120°

mercially developed and applied. From the time of Hero of Alexandria to that of Sir Charles Parsons, and from the days of Branca to those of de Laval, covering many centuries, little or nothing was done to produce a purely rotative type of heat engine. In recent years there has been so much progress made that it is difficult to understand why the significance of the principles involved was for so long not appreciated.

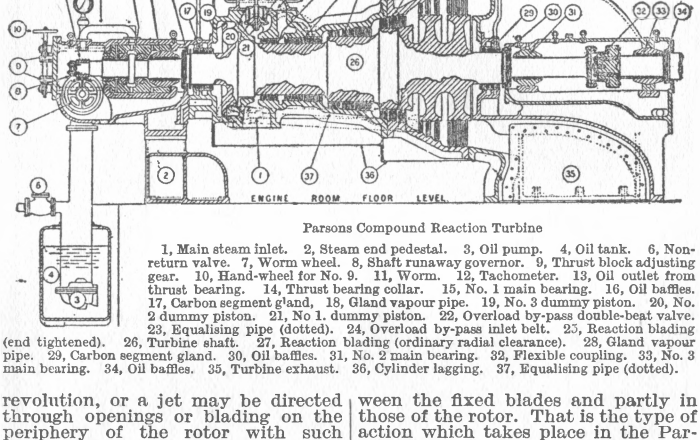
The many systems of working are based on two properties of jets of steam. The *impulse* given by the impinging of a jet upon a rotatable structure may cause its continuous revolution, or a jet may be directed through openings or blading on the periphery of the rotor with such changes of direction as make possible the use of its *reaction* to keep the turbine turning. In the first case the steam is expanded right away to its exhaust pressure, while in the other the expansion is carried out continuously in many stages. The conditions of the use of the steam turbine are entirely different from those of a steam-engine, in which the simple static pressure is utilised. In the impulse type of turbine the steam is passed through nozzles to expand it to the pressure of the exhaust. In that way the heat energy of the steam is first converted into kinetic energy before the conversion to mechanical work.

In the reaction type of turbine the expansion of the steam and the conversion of some of the heat into kinetic energy is conducted within the nozzle channels between the blades of the rotor. There are many systems of classifying steam turbines. As they commonly take the form of combinations of the fundamental types they may be referred to by the joint names of these types or by others, perhaps more informative, or again by a name indicating the class of duty they have to perform. They may be constructed as simple or compound sets just as is the case with steam-engines.

The pure reaction system is not commercially used, but the term reaction is employed to cover the type of machine in which the expansion is partly carried out in the space between the fixed blades and partly in those of the rotor. That is the type of action which takes place in the Parsons turbine. When an impulse turbine is combined with a reaction one the name "combination turbine" is frequently applied. The combination turbine was introduced to get over the leakage troubles at the high-pressure end of a reaction turbine.

As the blading at the high-pressure end is very short and there are mechanical limits to the reduction of the clearances, the area of passage for leakage is an appreciable proportion of the total. It may of course be got over by making the clearances axial instead of radial, but there is also the alternative of using impulse blading on discs for the first stage in the expansion. The combined impulse type of turbine shows signs of increasing favour where very large outputs are required.

The pure impulse turbine due to



Parsons Compound Reaction Turbine

1, Main steam inlet. 2, Steam end pedestal. 3, Oil pump. 4, Oil tank. 6, Non-return valve. 7, Worm wheel. 8, Shaft runaway governor. 9, Thrust block adjusting gear. 10, Hand-wheel for No. 9. 11, Worm. 12, Tachometer. 13, Oil outlet from thrust bearing. 14, Thrust bearing collar. 15, No. 1 main bearing. 16, Oil baffles. 17, Carbon segment gland, 18, Gland vapour pipe. 19, No. 3 dummy piston. 20, No. 2 dummy piston. 21, No 1. dummy piston. 22, Overload by-pass double-beat valve. 23, Equalising pipe (dotted). 24, Overload by-pass inlet belt. 25, Reaction blading (end tightened). 26, Turbine shaft. 27, Reaction blading (ordinary radial clearance). 28, Gland vapour pipe. 29, Carbon segment gland. 30, Oil baffles. 31, No. 2 main bearing. 32, Flexible coupling. 33, No. 3 main bearing. 34, Oil baffles. 35, Turbine exhaust. 36, Cylinder lagging. 37, Equalising pipe (dotted).

de Laval is manufactured by Messrs. Greenwood & Batley of Leeds in standard sizes from 5 to 500 h.p. As the whole expansion from admission to exhaust pressure is carried out in a single stage the steam speed is exceedingly high, and its kinetic energy must be taken from it by the use of a very great speed of running for the turbine. Actually the small power sets run at 30,000 revolutions per minute, while the larger ones have a speed of 10,000 revolutions per minute.

The speed of running of the small de Laval turbine is believed to be the highest ever attained on any practical and useful mechanical device. To obtain a suitable speed for an electric generator driven by a de Laval turbine, gearing must be introduced and the double reduction type is favoured. A reduction of from 10 to 1 on the smaller sets, to 13 to 1 in the larger ones, is arranged for. The driving of a rigidly held shaft at such high speeds would cause endless breakdowns and trouble, and in consequence floating bearings are used which can accommodate themselves to any condition of running.

The de Laval turbine may be described as a single-pressure stage turbine with single-velocity stage. This system of classifying turbines is much used. The single-pressure stage turbine is one on which all the pressure drop occurs on one set of nozzles, and the statement that it has a single-velocity stage means that the velocity is taken out of the steam on a single row of blading. The simple single Curtis wheel is a single-pressure turbine with two or more velocity stages.

A type of impulse turbine which is extensively used is that on which the heat drop is divided over a number of stages, and sets of nozzles combined with single-velocity stages. In this the heat drop in each stage may be made the same, but it is usually the practice to have a larger heat drop in the first stage than in the remainder. This gives the advantages of reducing the total number of wheels required, and keeping down the maximum temperature and pressure within the turbine casing. The types of turbine of this class in common use are the Rateau and the Zoelly.

When the multiple-pressure stages are combined with multiple-velocity stages, the heat drop on each step can be advantageously increased and the number of pressure stages may be cut down. The Curtis turbine is the outstanding example of this class. It has now become a common practice to combine the two last-mentioned types. The first part of the turbine is then a Curtis wheel which has two rows of blading, permitting the use of a longer heat drop on the first stage with good efficiency. In that way the Curtis-Rateau and the Curtis-Zoelly were developed.

In the reaction turbine pressure drops must occur across the moving blades as well as across the fixed ones. The blades of the Parsons turbines are not commonly increased continuously in size, but are arranged in groups, within which they have the same dimensions. In the Ljungström reaction turbine the steam passes through the blade rings in a radial direction. There are no fixed blades, but the alternate rings are connected to two discs which rotate in opposite directions.

The history of the development of the marine steam turbine began in 1894, when the Hon. Charles A. Parsons put the *Turbinia*, an experimental boat of 100 feet length, 9 feet beam, and 3 feet draught, and of 44 tons displacement, into commission. The remarkable results obtained with that boat led the Admiralty, in 1898, to use the system of propulsion in the torpedo-boat destroyers *Viper* and *Cobra*, with which very high speeds were attained, but both were lost through accidents, and the public became rather apathetic to the steam turbine.

A large part of the credit for the development of the system is due to the late Mr. John Williamson, who, in 1900, approached Messrs. Denny & Co., of Dumbarton, and Messrs. Parsons with a scheme for a steamer. The enterprise of Williamson led to the successful application of the steam turbine in the *King Edward* (1901), and in the *Queen Alexandra* (1902), and the results obtained gave confidence to ship owners.

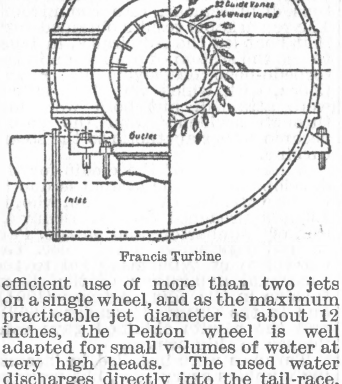
Turbines were installed in increasing numbers every year, but progress was slow until the introduction of helical reduction gearing (*see* GEARING). The gearing used at first was of the single reduction type, but nowadays the use of double reduction gearing in large turbine-driven merchant ships is almost universal.

TURBINE, WATER. A machine in which the energy of a jet of water is converted into mechanical rotation. It consists of a series of blades or vanes on a cylindrical frame mounted on a shaft, and the jet impinges on these blades in turn and causes the rotation of the shaft. Turbines are of two classes, *impulse* and *reaction* turbines. Of the former the Pelton wheel, and of the latter the Francis turbine are the most modern types.

In an impulse turbine the whole head of the supply water is converted

into kinetic energy before the wheel is reached. The water leaves the nozzle or nozzles in one or more high-velocity jets, which are exposed to the pressure (usually atmospheric) obtaining in the turbine casing. It then impinges on a series of buckets carried by the wheel, and, in virtue of the change of direction and momentum produced by the buckets, exerts a driving force. The pressure of the water remains uniform during its passage through the turbine.

The peripheral velocity of a Pelton wheel for maximum efficiency is slightly less than half the spouting velocity of the jet, and for this reason it enables the rotative speed to be kept within moderate limits. Since the design does not lend itself to the efficient use of more than two jets on a single wheel, and as the maximum practicable jet diameter is about 12 inches, the Pelton wheel is well adapted for small volumes of water at very high heads. The used water discharges directly into the tail-race, so that where the tail-race level varies appreciably the wheel must be placed above the highest tail-water level, with some sacrifice of head.



Francis Turbine

For heads between 400 and 750 feet the choice of Pelton wheel or reaction turbine depends largely upon local circumstances and on power required, but for heads greater than 750 feet the Pelton wheel is preferable. The greater simplicity and accessibility of the parts requiring replacement from wear and tear render the Pelton wheel suitable when the supplying stream carries grit or silt in suspension.

The nozzle is always circular in section, with axial needle or *spear* for regulating the size of jet, by partially closing up the nozzle orifice. Other shapes of jet suffer greater loss by windage, and tend to become circular and to become unsteady in the process. For high efficiency the diameter of the pitch circle of the buckets should not be less than about twelve times the diameter of the jet. The buckets are shaped with a knife-edged central ridge, so as to split the jet and give it a backward deflection as smoothly as possible. To avoid loss of energy, that portion of the lip in the line of the jet is omitted, as otherwise the lip would deflect the jet radially inwards and interfere with the smooth action in throwing the water backwards.

Friction losses in the buckets increase with the wetted area, so that the number of buckets is made as small as possible consistent with having continuous impact. The jet cannot be deflected through the full 180° without fouling the back of the following bucket, 165° being about the maximum deflection. The width of buckets is about three to four times the diameter of the jet, the ratio diminishing as the jet size increases.

The *pressure* or *reaction turbine* consists essentially of a wheel, or *runner*, with vanes into which water is directed over the whole periphery by a series of *guide vanes*. The water on leaving the guide vanes is under pressure, and supplies energy partly in kinetic and partly in pressure form. In passing through the runner the pressure increases the relative velocity of flow between the vanes, and the water finally leaves the runner at the pressure existing in the discharge pipe. The earliest type of reaction turbine had the guide vanes inside the runner, giving *outward flow*. This was followed by a type with the guide vanes above the runner giving *axial flow*.

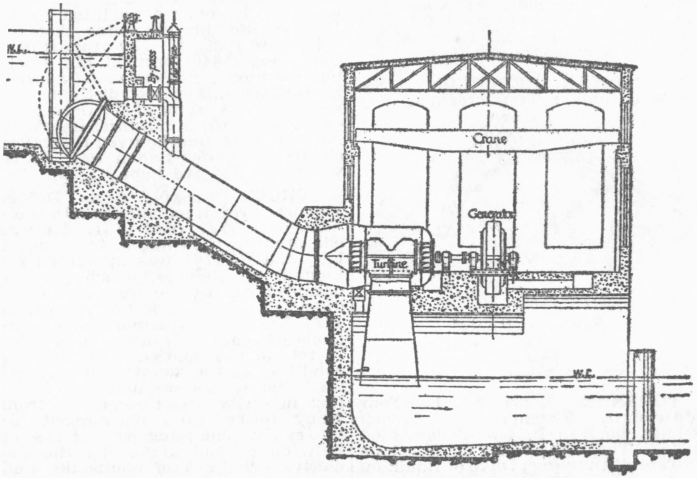
The modern type of Francis turbine has *inward flow*, but in order to obtain a large discharge area the buckets are formed to discharge in a direction nearly parallel to the axis. The peripheral speed for efficiency varies from 0·65 to 1·05 of the velocity head of the water supply according to the design, and this, together with the full peripheral admission, makes the reaction turbine suitable for moderate heads, high rotative speed, and large volumes of water. This type would be used for heads less than 400 feet, and up to 750 feet under favourable circumstances.

The water supply to the runner is regulated either by *cylinder gate* or by *pivoted guide vanes*. With cylinder gates excessive eddy formation at part gate gives low part-load efficiencies, but the cheapness and reliability make it of use in small plants. Guide vanes are commonly made of cast steel, but under very

gh heads where the water carries t, bronze vanes may be used to ist erosion. The corrosion of the nner under high heads, even with n-gritty water, may be due to ulty design of the vanes leading excessive eddy formation. The essure at the core of such eddies is mparatively low, leading to the eration from solution of air apparently containing nascent oxygen, hich rapidly attacks and pits any on or steel surface.

For a similar reason corrosion is pronounced at high heads if the turine is operated much at part gate. formed by the columns which transmit the weight of the unit to the concrete substructure.

The reaction turbine may either be submerged in the tail-water or may discharge into a *draft-tube* when the turbine is placed at a height above the tail-water. The maximum practical elevation depends on the diameter of the draft-tube, decreasing with an increase in diameter. This draft-tube may be designed with increasing area of cross-section, so that a large proportion of the kinetic energy of the discharge water may be converted into pressure head and



Arrangement of Power House with Double-wheel Turbines

If the guide vanes are pivoted, they are all attached to a ring, by the rotation of which all the vanes are closed or opened at the same time and uniformly. The rotation of the ring is controlled by the governor. The casing, bringing the supply water to all portions of the periphery of the runner, is of spiral volute form, and may be formed by moulding within the concrete substructure of the turbine itself if the head does not exceed about 100 feet.

For higher heads a metal casing is required for strength, and is formed of steel plates or cast steel. The two sides of the casing are tied together by a series of spacers surrounding the guide vane ring. These are shaped so as to guide the water into the guide vanes and form the *speed ring*. This ring occurs also in the concrete volute chambers of vertical shaft units, being utilised in this form. *See* HYDRAULICS AND HYDRAULIC MACHINERY; BREAST WHEEL; OVERSHOT WHEEL; UNDERSHOT WHEEL; HYDRO-ELECTRIC ENGINEERING.—BIBLIOGRAPHY: A. H. Gibson, *Hydro-electric Engineering; Hydraulics and its Applications;* F. C. Lea, *Hydraulics.*

TURBOT (*Rhombus maximus*). A valuable food-fish of the family Pleuronectidæ or flat-fishes. Next to the halibut, the turbot is the largest of the Pleuronectidæ found on the British coast, and is the most highly esteemed for the table. It is of a short and broad form, brown on the upper side, which is usually the left side, and attains a large size, weighing 20 lb. or more. The American or spotted turbot (*R. maculatus*), common on the coasts of New England and New York, attains a weight of 20 lb. See illus. p. 346.

TURCOMAN, or TURKMEN (the latter being the correct form). A Turanian people occupying mainly the Trans-Caspian division of the Soviet Republic of West Turkestan (see map under TURANIAN), and distributed in smaller numbers over Afghan Turkestan, North-Western Persia, Anatolia, etc.

The Turkmen are divided into seven chief tribes, of which the Salors are the oldest and noblest, and their total number is about 290,000. They have a primitive civilisation, and prior to their subjugation by Russia they were a fierce bellicose people; but they are now more or less peaceful, and have to a large extent forsaken the nomadic life and have settled down to agriculture, etc.

TURCOMAN REPUBLIC. *See* RUSSIA (table); TURKESTAN.

Turbot

TURENNE, Henri de la Tour d'Auvergne, Vicomte de. French soldier, born in 1611 at Sedan, died 1675. The second son of Henri de la Tour d'Auvergne, Duke of Bouillon, and of Elizabeth, Princess of Nassau-Orange (a daughter of William the Silent), he learned the art of war under his uncles Maurice and Henri of Nassau in the Dutch service. He entered the service of France in 1630, served with distinction in Germany and North Italy, and in 1643 received the command of the army of the Rhine in the Thirty Years' War, and was made a marshal. His successes in this post, as in the battle of Nördlingen (1645), greatly helped to win the war.

During the disturbances of the Fronde the victories of Turenne led to the termination of the Civil War. In the war against Spain he also distinguished himself, and after its close in 1659 he was named marshal-general of France. When war was renewed with Spain in 1667 he conquered Flanders in three months. In the Dutch War of 1672 Turenne had the chief command. He first marched against the Elector of Brandenbu and, having driven him back as i as the Elbe, forced him to sign t Treaty of Vossem in 1673; while the brilliant campaign of 1674-5 destroyed two Austrian armies in t battles of Mühlhausen and Türkhei and conquered and devastated t Palatinate. He was killed whi making preparations to engage Mo tecuculi.

TURGENEV, Ivan Sergeievitc Russian author. He was born 9t Nov., 1818, of a noble family, an educated in Moscow, St. Petersbur and Berlin. He was the first to mak western Europe acquainted wit Russian life, his character sketche being unsurpassed. His *Annals of Sportsman* (1846) brought him fame but his novel, *Fathers and Children* is perhaps his most distinguishe work. His somewhat outspoke opinions earned him a brief imprison ment in 1852, and he lived thereafte chiefly in Baden-Baden and Paris, where he died 3rd Sept., 1883.

TURGOT (tûr-gō), **Anne Robert Jacques.** French economist and states-man, born 1727, died 1781. He was educated for the Church, but studied law, and in 1761 was appointed intendant of Limoges, which post he occupied for twelve years. Shortly after the accession of Louis XVI. in 1774 Turgot was appointed Comptroller-General of France, and in order to reform the political and financial condition of the country, he moderated the duties on articles of the first necessity, freed commerce from many fetters, and encouraged industry by enlarging the rights of individuals, and abolishing the exclusive privileges of companies and corporations. Such, however, was the opposition of the clergy and nobility to his reforms that he was dismissed from office in 1776, and retired into private life.—BIBLIOGRAPHY: W. W. Stephens, *Life and Writings of Turgot*; F. de Ferry, *Les Idées et l'Œuvre de Turgot en matière de droit public.*

TURIN'. A mountainous frontier province of Piedmont, North Italy, whose boundaries march with the Swiss and French frontiers; drained by the headwaters of the Po. Coal, copper, etc., are found, and cattle are raised. Cottons, linens, silk, and nuts are exported. Turin is the capital. Area, 2116 sq. miles; pop. (1931), 1,147,149.

TURIN (ancient **AUGUSTA TAURINORUM**; It. *Torino*). A city of Piedmont, North Italy, capital of the province of Turin, at the confluence of the Dora Riparia with the Po,

and between those two rivers; the centre of railways from Aosta, Genoa, Cuneo, Modane, Rivoli, Chieri, Savona, Mailand, etc., and of steam-tramways to Saluzzo, etc.

The chief buildings are the cathedral, a Renaissance building, completed in the beginning of the sixteenth century, and remarkable for its marble façade; the royal palace, a plain brick building, which contains the king's private library, with valuable MSS., and the royal armoury; the university; the Palazzo Carignano, used at one time by the Sardinian and Italian Parliaments when they met here (1848-65), and now given up to a collection of natural history; and the Madama Palace, in the Piazzo Castello, the hub of the city's daily life.

Among the educational establishments, besides the university, are the episcopal seminary, Royal Military Academy, and a polytechnic school. Manufactures consist, besides the staple of silk, chiefly of woollens, cottons, linen, paper, ironmongery, earthenware, and porcelain.

In Roman times Turin was the chief town of the Taurini, was conquered by Hannibal (218 B.C.), and became a colony, receiving under Augustus the name *Augusta Taurinorum*. From the eleventh to the fifteenth century it was alternately in possession of France and Savoy, when it became, until 1860, capital of the Kingdom of Sardinia and, until 1865, of United Italy. The city has a broadcasting station (273·7 m., 7 kw.). Pop. (1931), 597,260.

TURKANA. A negro tribe of Uganda, occupying mainly the Turkana and Dabossa districts of Rudolf Province, but allied linguistically, etc., to the Karamojo of Uganda and Kenya. They are of great stature (average 7 feet), and depend upon cattle, and fish from Lake Rudolf and the swamps, for a livelihood, sheep and goats being raised in enormous numbers, cattle largely bred, and camels and donkeys kept. Their steppe-land is arid and almost Saharan at times, the annual rainfall never exceeding 10 inches, and sometimes failing entirely for several years.

The Turkana are nomads, but the Karamojo are more settled and have some commerce and agriculture. Their chief features are: Clothing, nil; ornaments, few; no circumcision; wonderful hairdressing, the hair of ancestors being made up and worn; great hunters; arms, spear and wrist knives; an everlasting pest to European administrators.

During the European War the Turkana caused grave trouble. At the end of 1914 they carried out a cattle-raid, and the Uganda Police, assisted by Sudanese troops, surprised them at Pelegech Mountain, taking many cattle. Early in 1915 a larger expedition became necessary, during which the paramount chief of the Turkana lost a large number of followers and many cattle. From that time efforts have been made to force the tribes into the Sudan. There were also expeditions in 1917 and 1918.

TURKESTAN. A region of Soviet Central Asia, usually divided into West and East Turkestan. West (formerly Russian) Turkestan comprises that part of the Asiatic territories of the Union of Socialist Soviet Republics which lies east of the Caspian and south of the Aral Sea and Lake Balkhash, as well as that part of Afghanistan lying north of the Hindu Kush. It is watered by the Oxus and the Sir Darya; the east is largely desert, and it includes the Pamir plateau.

The climate is extreme and dry, some wheat, rice, and cotton are grown, and sheep, horses, and camels are raised. Minerals include silver, gold, copper, iron, etc. The population is composed of Sart, Tazhik, Uzbek, Turcoman, Kirghiz, etc., elements. Area, *c.* 420,000 sq. miles; pop. estimated at 7,000,000.

West Turkestan was overrun by Mongols in the eleventh century, belonged to the empire of Tamerlane in the fourteenth century, and was then divided into independent states. It passed to Russia in the nineteenth century, and in 1918 a short-lived Republic of Turkestan was formed (see next article). East (former Chinese) Turkestan is that part of Sinkiang (q.v.) bounded by the Tien Shan, Kunlun and Karakorum Mountains, and the Gobi Desert. It is watered by the Tarim and contains the great Lop Nor marshes. Yarkand, Kashgar, and Khotan are the chief towns.

TURKESTAN REPUBLIC. Between 1918 and 1923 Russian Turkestan (*see* TURKESTAN) was divided into three Soviet republics (attached to the U.S.S.R.)—Turkestan (capital, Tashkent), Bukhara (q.v.), and Khorezm (q.v.). These republics ceased to exist as such in 1924, when the greater part of Khorezm was joined to Bukhara to form the Uzbek Republic and the autonomous Tadjik region. The remaining part of Khorezm, with part of Turkestan, became the Turcoman Republic, a portion of Turkestan went to the Kirghiz Republic, and the rest of Turkestan was divided into the Kara-Kalpak and the Kara-Kirghiz regions. *See* RUSSIA (table).

TURKEY. A republic of the Near East, comprising a small part of Eastern Thrace (Europe), the great peninsula of Asia Minor or Anatolia, and Imbros, Tenedos, and the Rabbit Islands; total area, 494,538 sq. miles; pop. (1927), 13,648,270 (European Turkey area, 9257 sq. miles; pop. 1,004,669). By the Fundamental Law of 1921 (see below) a policy of decentralisation in local government was introduced—the country is divided into *vilayets* (at the head of each being a Government representative known as a *vali*), each vilayet is subdivided into *kazas*, and each *kaza* into *nahye* or communes, which are autonomous entities (except in affairs reserved for the State).

Turkey in Europe is bounded by the Black Sea, Bulgaria, Greece (the River Maritsa), the Dardanelles, the Sea of Marmara, and the Bosporus, and is well watered, mainly by tributaries of the Maritsa. Hill ranges run along the Black Sea and the Sea of Marmara (stretching into Gallipoli). *See* THRACE.

Physiography: Anatolia.[1]—The exact boundaries of Anatolia are rather vague physically, but they are clear enough politically. Physically, the country forms an extension towards Europe of the Iranian Plateau, cut transversely into halves by the Anti-Taurus range, and flanked on all sides by mountain ranges like buttresses. The general slope of the plateau is from east to west, from the mountain knot of Armenia (3000 feet altitude) to the Ægean escarpments (1000-1500 feet altitude); and the average breadth is from 300 to 400 miles. The plateau consists of great, undulating, scrub-covered plains, broken here and there by isolated volcanic necks (Erjias Dagh—twin cones—11,830 feet altitude), a region of short scorching summers and long freezing winters when the temperature in the eastern area is frequently as low as −20° F.

A feature of the plateau, west of

[1] For convenience of reference Constantinople and the circumjacent region of Thrace have been treated separately under *Thrace* and *Constantinople*.

the Anti-Taurus, is the Salt Plain, comprising Tertiary lacustrine deposits; and the fringe of lakes among which Tuz Geul (salt) is conspicuous and is the centre of a large area of inland drainage. In flora, fauna, and climate the whole region is indistinguishable from the Russian steppes.

The rim-mountains and coastal plains may be considered regionally. (1) In the north is the Black Sea or Pontic zone, distinguished by its broad mountain range, which slopes gently southwards to the plateau, but presents a steep, almost abrupt face rising from the Black Sea on the north. Few river valleys penetrate the mountains, and the small deltaic littoral-plains formed by the swift-flowing rivers Kizil-Irmak and Yeshil-Irmak are of great importance.

Samsun and Trebizond are the centres of practicable routes to Sivas and Central Asia respectively. The Sakaria River also flows into the Black Sea, and is navigable for over 100 miles by small craft; but none of the Anatolian rivers is navigable to any extent. The climate of the Pontic zone is distinguished by its heavy rainfall.

The mountains intercept the moisture-laden north winds, which, as dry blasts, pass over the plateau of the interior. This accounts for the semi-arid nature of the largest part of the plateau, where the maximum rainfall occurs in spring. In the Pontic zone the winters are cold and damp, with frequent snowfalls; but the summers are warm. (2) In the south is the Taurus range (6000-9000 feet altitude), higher and less broken than the Pontic, and presenting also a steep escarpment to the sea, except around Adana, which lies in the unhealthy plain of Cilicia, and at Adalia, in the Pamphylian plain.

Through the Taurus to the hinterland the only road is by the narrow gorge of the Cilician Gate, behind Adana, and this is used by the railway. The chief rivers are the Sihun and Jihun, both reaching the Mediterranean through the Cilician plain.

As in the west, the climate of the southern zone is of a Mediterranean type, but colder in winter and warmer and drier in summer. (3) The western or Ægean zone is the richest and most pleasant of Asiati Turkey. Rias, such as those of South-Western Ireland or North-Western Spain, penetrate far into the mainland, separated from each other by narrow, dissected fingers of the main plateau. It is here that East really meets West, that Europe and Asia rub shoulders not only geographically, but also historically.

The Marmara littoral in part, and the zone of the Straits may be considered as part of the western zone. The mountains are much broken as the coast is approached, and the historic valleys of the Gediz Chai (*Hermus*) and Menderes Chai (*Mæander*) form easy lines of communication with the plateau. The latter valley has many thermal springs.

In the north-west of this zone there is a freshwater lake district (around Brusa), the most important lakes being Abullionț Geul, Isnik Geul, and Maniyas Geul; the atmosphere is very clear and exhilarating, and the excellence of the climate is surpassed only by the magnificence of the fauna and flora. Smyrna is the metropolis of the Ægean zone.

Production and Industry. Turkey is generally fertile, but agriculture is very backward. Cereals, especially wheat, are grown, and tobacco is an important crop both in Europe and in Asia (Samsun, Smyrna, etc.). Other valuable products are opium (Konia, Afiun Qarahisar etc.), olives and olive-oil (Aidin), fruits (Marmara littoral), silk (Brusa, Istanbul), cotton (Aidin, Cilicia, and Marmara littoral), honey, wax, liquorice, gums, sesame, nuts, almonds, and canary seed. Stock-rearing is important, especially in Central Anatolia, and there are large numbers of Angora goats (for mohair), sheep, cattle, camels, mules, etc. Forests of oak, walnut, pine, cedar, larch, elm, chestnut, etc., cover 17,000,000 acres in Anatolia, but though 88 per cent are State-owned there is no reservation system.

Fisheries are valuable but are underdeveloped. The mineral wealth is very great but is almost unexploited, though coal, meerschaum (near Eskishehr), chrome ore, lead, zinc, borax, emery (south of Smyrna), copper, fuller's earth, and salt are worked to some extent. Gold, mercury, antimony, and asphalt are also found. Anatolian manufactures are almost entirely undeveloped, but carpets, as a cottage-industry, are important.

The basis of this industry is the mohair of the Angora goat; the madder and valonia for dyeing it are produced from specially grown species of oak. Aidin vilayet is the greatest carpet-producing region. Brusa is the centre of a silk-producing region, and there is some production of silk fabrics as well as of cottons. Smyrna leads all Anatolia as far as industrial enterprise is concerned.

Commerce. A peculiarity of trade in Anatolia is that it is adversely influenced by religious observances. Friday, Saturday, and Sunday are holy days of Mahommedan, Jew,

and Christian respectively, and none of them will buy or sell upon his sacred day. This imposes a heavy burden on the rest of the week, and is an unsatisfactory arrangement when compared with European standards.

Considerable development of transport facilities and agricultural exploitation will be necessary before Anatolia ranks as economically alive. The main imports are textiles, flour and cereals, woollens, silks, sugar, metals, oils, fats and soaps, and animal products. Exports are mainly tobaccos, dried fruit, wool and mohair, olive-oil, skins, silk, cotton and cotton-goods, and opium. The value of exports in 1932 was £T101,303,355 (£T10,640,466 to Britain), and of imports £T85,983,723 (£T9,974,613 from Britain).

Currency, Weights and Measures. The currency standard is gold, and the unit is the *piastre* of 40 *para*. In 1929 the exchange was stabilized at 1030 piastres = £1. The metric system comes into force in 1934. Since 1st Jan., 1926, the Gregorian Calendar alone has been used.

Communications. There are in Turkey about 3619 miles of railway track (210 miles being in Europe), and several constructional schemes are being carried out.

Defence. The peace strength of the army is 20,000 officers and 120,000 men, and the navy (one battleship, two light cruisers, two gunboats, three minesweepers, four destroyers, and several small craft) is being reorganised and repaired. All the ships are old, though a few small craft are under construction.

Izmid is now the naval base (replacing the Golden Horn), and has an ex-German floating dock of 26,000 tons. A small air force is being developed with head-quarters at Smyrna. The State religion was, till 1928, Islam, there being few non-Moslems, outside Istanbul (which has a considerable Armenian and Greek population). In 1928, however, by decree of the Grand National Assembly, it ceased to be recognised by the State. The population of Anatolia is almost entirely Turkish, though there are considerable Kurd and Arab elements.

There are now few Armenians in Anatolia, and by an agreement with Greece (Lausanne, 1923) Greeks in Turkey are being exchanged for Moslems in Greece.

Education. Education is nominally compulsory, and (except for foreign missionary schools in Istanbul and Smyrna or Izmir) is now secular and State supervised. There is a university at Istanbul. In 1925 a School of Law was established at Ankara, where students receive instruction in the new laws of Turkey. Since 1928 the Latin alphabet has supplanted the Turkish, and the publication of books in Arabic characters has been forbidden since 1929. See also ASIA MINOR; CONSTANTINOPLE. For Constitution, recent history, etc., see below.

Ports and Towns. Ankara is the capital of Nationalist Turkey; Konia is rapidly becoming an important centre of trade, and has adjacent sugar plantations; Kaisariah; Brusa is the only really important inland town (pop. about 61,690). Ports are distributed according to zones. On the Black Sea are Trebizond, Samsun, Sinope, and the Heraclea coal-field ports (*see* SONGULDAK), with Eregli.

Marmara ports include Izmit, Gemlik (pop. 5000), Mudania (5000), Panderma, and Chanak on the Dardanelles (22,000). Mediterranean ports include Aivali (17,000), Dikeli, and Smyrna in the Western or Ægean zone; and Marmarice, Makri, Adalia, Mersina, and Ayas in the Pamphylian-Cilician littoral. Ayas Bay is the finer deep-water port on the south coast.

In European Turkey the chief town (and the largest in the republic) is Istanbul, one suburb of which, Scutari, is in Asia. The only other European town of any considerable importance is Edirne.

Ethnology. What is a Turk? This question has frequently been expressed as the conundrum, "When is a Turk not a Turk?" and in the days of the Committee of Union and Progress there was but one answer, "When he's a Young Turk," for it is notorious that many of the most influential revolutionaries were not Turks at all. The Ottoman Empire presented, and Nationalist Turkey still affords, a peculiar example of a powerful *state* that is not a *nation*. There is no such thing as a Turkish nation as the word is generally understood, for Turkey is a congeries of discrete peoples who are not so much to be distinguished by nationalities as by religions; and under the Empire the name of their religion formed the political designation of the various races. Sunnite Mahommedanism was the State faith, and the Sultan was Caliph of Islam, the vicar of God;[1]

[1] Sunnite Mahommedanism and the Caliphate maintain their position in Nationalist Turkey. The Sultan of Turkey was the *generally* recognised spiritual head of Islam, and his position resembled that of H.M. The King Emperor as *Defender of the Faith*, in that it is admitted by some without question, but accepted rather unwillingly by others. As regards the *millets*, it has been cleverly suggested that as bigamy is not a recognised crime in Turkey,

but provision was made for the granting of almost complete autonomy to certain regions, of which the adherents were grouped together in *millets* and sent representatives direct to Constantinople.

Nationalist Turkey is a congeries of peoples just as was the old Ottoman Empire; but the main point to be distinguished is that the Nationalist State is preponderatingly Moslem, and claims not so much to be a European Power as to be a free Asiatic Sultanate. This recalls the fact that Asiatic Turkey in general, and Anatolia in particular, was always the bulwark of the Ottoman power during the Imperial régime, despite the centralisation of administration at Constantinople.

At the moment, Anatolia is a political entity governed from within, a state of affairs which has not obtained since Hittite times. The various races comprising the Turkish State are as follows: *Armenians* (Catholic and Gregorian), found in Adana, Sivas, Ankara, and Trebizond regions; *Kizilbashis* (pagans with a thin Islamic veneer), Ankara-Amasia region and around Tokat; *Jews*, Marmara littoral, Bosporus, and all large towns; *Arabs* (Moslem), in Adana; *Greeks* [2] (Orthodox mainly), Adana, Aidin, Konia, Ankara, Kastamuni, Trebizond, Sivas: generally scattered all over, with a percentage of European Greek immigrants around Smyrna; *Kurds* (Moslem), Ankraa and Sivas; *Lazes* (people of Caucaso-Tibetan race—mainly Moslem), scattered all over, but mainly found in the hills of Trebizond; *Circassians* (Moslem), have many settlements; *Gipsies* (Moslem), found all over; *Abkhasians* (Moslem); and Tatars, Turkmen, Avchar, and Yuruks, all nomadic people of Turanian origin.

The miscellany of races is due primarily to the peculiar geography of Asia Minor, which made it in ancient times a battle-ground on which the fate of empires was decided.

Turks. It is exceedingly difficult to discuss the word "Turk" from an ethnological standpoint, for it is identical in meaning with Turanian (q.v.). Moslem adherents of the House of Osman call themselves "Osmanlis," not "Turks," although apostles of Pan-Turianism (q.v.) have endeavoured to give the name a special significance. Politically, a Turk is an Osmanli (as mentioned above), although Arabs, for example, are scarcely to be considered as such.

Linguistically, Turkish forms a division of the Ural-Altaic family of languages (q.v.). Space does not permit of a lengthy discussion of the various reasons "why a Turk is not a Turk," but, generally speaking, it is safe to confine the application of the name to the people who conquered and still govern (Istanbul) Constantinople, and who have racial and linguistic affinities with the Turanian peoples discussed under *Turanian*.

History. The Ottoman Turks came originally from the region of the Altai Mountains, in Central Asia, and in the sixth century A.D. pushed onward to the west in connection with other Turkish tribes. Early in the eighth century they embraced Islam, and in the thirteenth century they appeared as allies of the Seljuks (q.v.) against the Mongols, and for their aid received a grant of lands from the Seljuk Sultan of Iconium, in Asia Minor. Their leader, Othman or Osman, of the race of Oghuzian Turcomans (Turkmen), became the most powerful emir of Western Asia, and after the death of the Seljuk Sultan of Iconium (1300) he proclaimed himself Sultan. He died in 1326.

it was essential to the well-being of any Christian community domiciled there that it should have power to deal with offences in this and any other respect at variance with *Mussulman* practice. Apart from that, the system afforded the Christians a splendid opportunity of acquiring a wide education and culture, which rather discredits ill-informed reports regarding the educational backwardness of the entire people. Nominally, of course, elementary education was, by law, compulsory between the ages of seven and sixteen years. The much-advertised atrocities appear to have been exaggerated, despite the cold-blooded extirpation schemes (alleged) attributed to Talaat Pasha, and it is an actual fact that there is much less agreement between different *Moslem* nationals than there is between Christian and Christian, and Christian and *Moslem*. For example, the bullying, arrogant Circassian from the Caucasus, whence he was driven (along with the Abkhasians) by the Russian occupation, stirs up strife wherever he goes, and is entirely incapable of living in harmony with his *Moslem* brethren with whom the Christians and Jews are seldom in trouble.

Nationalist Turkey shows even more clearly than the old Empire that the binding force which cements this racial miscellany into some semblance of an orderly community is the dominant military caste, which is linked up with Islam all over the world through the Royal House of Osman, whose lineal descendant wears that warrior's sword and is nominally master in the house that, since the deposition of Abdul Hamid, has been ruled by free-thinking Young Turks, with a larger share of worldly knowledge and a smaller love of Islam and the Prophet than their ancestors would have dared even to aspire to.

[2] By Greeks are meant those who became "Greeks" during the period when Asia Minor was more or less hellenised, a period which ended in the sixth century A.D. They became "Greeks" politically, and as such they have always been considered. Thus it is that the Anatolian "Greeks" are descendants of the Byzantine Anatolians, and are politically, linguistically, and theologically (but not racially) Greek. The common racial stock is identical, but one branch embraced Islam, the other Christianity; and although the two have developed side by side, time has only served to make the cleavage in sympathy absolute.

Thus was founded upon the ruins of the Saracen, Seljuk, and Mongol power the Empire of the Osmanlis or Ottoman Turks in Asia; and after Osman, the courage, policy, and enterprise of eight great princes, whom the dignity of Caliph placed in possession of the standard of the Prophet, and who were animated by religious zeal and a passion for military glory, raised it to the rank of the first military Power in both Europe and Asia (1300-1566).

The first of them was Orkhan (1326-59), son of Osman. He subdued all Asia Minor to the Hellespont, took the title of *Padishah*, and became son-in-law to the Greek emperor Cantacuzenus. Orkhan's son, Suleiman, first invaded Europe in 1355. He fortified Gallipoli and Sestos, and took possession of the straits now called the Dardanelles.

In 1360 Orkhan's second son and successor, Murad I. (1359-89), took Adrianople, which became the seat of the empire in Europe (1367), conquered Macedonia, Albania, and Serbia, and defeated a great Slav confederation under the Serbian king Lazar I. at Kosovo (1389), but was assassinated just after the victory, and Bayezid surnamed *Ilderim* (lightning), was proclaimed king on the field as Bayezid I. (1389-1403). He invaded Thessaly, and also advanced towards Constantinople.

In 1396 his Janissaries defeated the Western Christians under Sigismund, King of Hungary, at Nicopolis, in Bulgaria; but at Angora in 1402 he was himself conquered and taken prisoner by Timur the Lame, who divided the provinces between the sons of Bayezid. Finally, in 1413 the fourth son of Bayezid, Mahommed I. (1413-21), seated himself upon the undivided throne of Osman. In 1415 his victorious troops reached Salzburg and invaded Bavaria.

He conquered the Venetians at Thessalonica in 1420; and his grandvizier, Ibrahim, created a Turkish navy. Mahommed was succeeded by his son Murad II. (1421-51), who defeated Ladislaus I., King of Hungary and Poland, and John Hunyadi at Varna in 1444. Mahommed II. (1451-81), the son of Murad II., completed the work of conquest. He attacked Constantinople, which was taken on 29th May, 1453, and the Byzantine Empire came finally to an end.

Mahommed II. added Serbia, Bosnia, Albania, and Greece to the Ottoman Empire, and threatened Italy, which, however, was freed from danger by his death at Otranto in 1481. He was surnamed *The Conqueror*, and to him was due the Ottoman administrative system, which existed intact down to the time of Mahmud II.; and the organisation of the *ulema* was his crowning work. His grandson, Selim I. (1512-20), who practically deposed his father, Bayezid II. (1481-1512), conquered Egypt and Syria.

Under Suleiman I. (*The Magnificent*, 1520-66), the Ottoman Empire reached the highest pinnacle of power and splendour. In 1522 Suleiman took Rhodes from the Knights of St. John, and by the victory of Mohacs in 1526 subdued half of Hungary. He exacted a tribute from Moldavia, made Bagdad, Mesopotamia, and Georgia subject to him, and threatened to overrun Germany.

Suleiman had as an opponent Charles V. of Germany, as an ally Francis II. of France, but he was checked before Vienna (1529), and this episode forms the highwater mark of Turkish success. From this time the history of Turkey is a story of disintegration and decay, which culminated in the Treaty of Sèvres (1920), the end of the Ottoman Empire, and the rise of a new Turkey, like a Phœnix from the ashes of the old.

In the latter part of the sixteenth century, and most of the seventeenth century, the chief wars were with Venice and with Austria. The battle of Lepanto (1571), in which the Ottoman fleet was overthrown by the combined fleets of Venice and Spain, was the first great Ottoman reverse at sea; and the battle of St. Gothard (1664), near Vienna, in which Montecuculi defeated the Vizier Kuprili, the first great Ottoman reverse on land. In 1683 Vienna was besieged by the Turks, but was relieved by John Sobieski and Charles of Lorraine; in 1687 the Turks were again defeated at Mohacs, and in 1697 (by Prince Eugène) at Szenta.

Then followed the Treaty of Karlowitz in 1699, by which Mustapha II. (1695-1703) agreed to renounce his claims upon Transylvania and a large part of Hungary, to give up the Morea to the Venetians, to restore Podolia and the Ukraine to Poland, and to leave Azov to the Russians.

Eugène's subsequent victories at Peterwardein and Belgrade obliged Ahmed II. (1703-30) to give up, by the Treaty of Passarowitz in 1718, Temesvar, Belgrade, with a part of Serbia, and Wallachia; but the Turks, on the other hand, took the Morea from Venice, and by the Treaty of Belgrade in 1739 regained Belgrade, Serbia, and Little Wallachia, while for a time they also regained Azov.

Russia, which had been making steady advances under Peter the

Great and subsequently, now became the great opponent of Turkey. In the middle of the eighteenth century the Ottoman Empire still embraced a large part of Southern Russia. The victories of Catharine II.'s general Romanzov in the war between 1768 and 1774 determined the political superiority of Russia, and at the Peace of Kuchuk-Kainarji, in 1774, Abdul Hamid I. (1773-89) renounced his sovereignty over the Crimea, yielded to Russia the country between the Bug and the Dnieper, with Kinburd and Azov, and agreed to open his seas to Russian merchant ships.

By the Peace of Jassy (Rum. *Iasi*), 1792, which closed the war of 1787-91, Russia retained Taurida and the country between the Bug and the Dniester, together with Otchakov, and gained some territory in the Caucasus. In the long series of wars which followed the French Revolution, the Ottoman Empire first found herself opposed to France, in consequence of Bonaparte's campaign in Egypt, and finally to Russia, who demanded a more distinct recognition of her protectorate over the Christians, and to whom, by the Peace of Bucharest (28th May, 1812), she ceded that part of Moldavia and Bessarabia which lies beyond the Pruth.

In 1817 Mahmud II. (1808-39) was obliged to give up the principal mouth of the Danube to Russia. Further disputes ended in the Porte making further concessions, which tended towards loosening the connection of Serbia, Moldavia, and Wallachia with Turkey.

In 1821 broke out the War of Greek Independence. The remonstrances of Britain, France, and Russia against the cruelties with which the war against the Greeks was carried on proving of no avail, those Powers attacked and destroyed the fleet (Turco-Egyptian) of Mahmud at Navarino (1827). In 1826 the massacre of the Janissaries took place at Constantinople, after a revolt. In 1828-9 the Russians crossed the Balkans and took Adrianople, the war being terminated by the Peace of Adrianople (1829).

In that year Turkey had to recognise the independence of Greece. In 1831-3 Mehemet Ali, nominally Pasha of Egypt, but real ruler of both Egypt and Syria, levied war against his sovereign, and was threatening Constantinople when Russia, who had been called on for aid by the Sultan, forced the invaders to desist. In 1840 Mehemet Ali again rose against his sovereign, but, through the active intervention of Great Britain, Austria, and Russia, was compelled to evacuate Syria, though he was, in recompense, recognised as hereditary Pasha of Egypt.

The next important event in the history of the Ottoman Empire was the war with Russia (1853) in which Turkey was joined by England and France. This war, known as the Crimean War (q.v.), terminated with the defeat of Russia, and the conclusion of a treaty at Paris (30th March, 1856) by which the influence of Russia in Turkey was greatly reduced.

The principal articles were the abolition of the Russian protectorate over the Danubian principalities (Wallachia and Moldavia), united in 1861 as the Principality of Rumania), the rectification of the frontier between Russia and Turkey, and the cession of part of Bessarabia to the latter Power.

In 1875 the people of Herzegovina, unable to endure any longer the misgovernment of the Turks, broke into rebellion. A year later the Serbians and Montenegrins likewise took up arms, and though the former were unsuccessful and obliged to abandon the war, the Montenegrins still held out. Meantime the Great Powers of Europe were pressing reforms on Turkey, and at the end of 1876 a conference met at Constantinople with the view of making a fresh settlement of the relations between her and her Christian provinces.

All the recommendations of the conference were, however, rejected by Turkey; and in April following, Russia, who had been coming more and more prominently forward as the champion of the oppressed provinces and had for months been massing troops on both the Asiatic and the European frontiers of Turkey, issued a warlike manifesto and commenced hostile operations in both parts of the Turkish Empire.

She was immediately joined by Rumania, who (22nd May, 1877) declared her independence. The progress of the Russians was at first rapid; but the Turks offered an obstinate resistance. After the fall of Kars, however (18th Nov.), and the fall of Plevna (10th Dec.), the Turkish resistance completely collapsed, and on 3rd March, 1878, Turkey was compelled to agree to the Treaty of San Stefano, in which she accepted the terms of Russia.

The provisions of this treaty were, however, considerably modified by the Treaty of Berlin concluded on 13th July, by which Rumania, Serbia, and Montenegro were declared independent; Rumanian Bessarabia was ceded to Russia; Austria was empowered to occupy Bosnia and Herze-

govina; and Bulgaria was made a tributary principality.

In 1876 Abdul Hamid II. succeeded to the throne, and in 1881 France occupied Tunis, while Great Britain took over Egypt to suppress disorders there. The Young Turk movement became gradually more active, and, in the belief that Abdul Hamid's despotic rule was the sole cause of Turkish humiliation by the Great Powers, the Young Turks organised the revolutionary movement which culminated in the violent political upheaval of July, 1908, when the Sultan was compelled to restore the "Constitution of 1876," and the Committee of Union and Progress, with the army supporting it, became the real master of Turkey. Abdul Hamid was dethroned in April, 1909, and exiled to Salonika.

He was succeeded by his brother, Reshad Effendi, as Mahommed V., and the Committee inaugurated a secret reign of terror, in course of which martial law was established, and a programme of compulsory Turkification in accordance with the Young Turk gospel of Turanianism was rigidly enforced. Their Pan-Turanian ideas were camouflaged by a brilliant display of Pan-Islamic ideals after the manner of Abdul Hamid, and this naturally aroused the antagonism of Great Britain, France, and Russia, while fostering the obvious friendship of the Committee with Germany and the Central Powers.

Italy, in 1911, began to seize for herself what she considered to be her rightful share of the "sick man's" potential legacy, and her troops landed in Tripoli and Cyrenaica. Peace was concluded by the Treaty of Lausanne, in which Italy agreed to surrender those islands of the Dodecanese occupied by her in return for free occupation of Tripoli; but the bargain never took effect.

Meanwhile Montenegro declared war on Turkey (8th Oct., 1912), and on 17th Oct. Turkey declared war on Serbia and Bulgaria. Greece declared war on Turkey on the following day, and hostilities immediately began, lasting until 3rd Dec., when an armistice was signed and unsuccessful negotiations began. On 3rd Feb., 1913, the war was renewed, and was finally concluded on 30th May. This was a signal for discord among the victorious Balkan allies; the Bulgarians attacked the allied Serbo-Grecian army (29th June), but, with Montenegrin and Rumanian assistance, the Serbo-Greeks drove back the Bulgar forces.

Enver Pasha had now come into prominence in Turkey, and he seized the opportunity to advance on Adrianople, and made so much political use of his military successes that Bulgaria was humbled. In the midst of her military reverses Turkey revealed the existence of what the Powers regarded as a secret military convention with Germany, when General Liman von Sanders took over command of the Dardanelles and Constantinople defences.

In June, 1914, the *Goeben* visited Constantinople, and both Pan-Islamic and Pan-Turanian ambitions drove Turkey into the European War on the side of Germany and the Central Powers; and in the flames of battle that between 1914 and 1918 raged all over the world Ottoman Turkey was consumed.

Only a few fragments remained of the Empire when the Treaty of Sèvres was forced upon the Turks in 1920, but the nucleus of Turkish power, Anatolia, remained practically unscathed; and the Turkish nation now began to exhibit that remarkable and entirely unlooked-for power of recovery in impossible circumstances that has characterised the race of Ottoman since its first appearance on the stage of authentic history.

Ottoman Turkey disappeared, and from Aug., 1920, there began a period of internal reconstruction and organisation that co-ordinated the new Turkish state into a military weapon which by 1922-3 was powerful enough to humiliate the Great Powers.

Nationalist Turkey. The formation of Nationalist Turkey was due to the occupation of Smyrna and Thrace by the Greeks, as a more or less natural consequence of the Anglo-Hellenic *rapprochement* fostered by Venizelos and Lloyd George. Till 1907 Britain had supported Abdul Hamid II. against Russia, but when that support ended with the signature of the Anglo-Russian Treaty in 1907, the crash of the Turkish Empire was inevitable. When Enver Pasha (who had become Grand Vizier in 1909) joined Germany in 1914, he was, in a sense, making a last frantic bid to save the Empire.

Damad Ferid Pasha became Grand Vizier after the European War, but Mustafa Kemal Pasha, disgusted at the maladministration, formed the nucleus of a national party at Angora in 1919, and established a military base at Ismid. The whole of Asia Minor in 1920 acknowledged Kemal's *de facto* Government—the Grand National Assembly of Turkey and the Sultan's Government had now no authority outside Constantinople.

Kemal had hoped that Britain might renew her understanding with Turkey, but it soon became obvious that the Anglo-Russian Treaty of

907 had been replaced by Anglo-Hellenism. The Treaty of Sèvres q.v.) in 1920 granted Smyrna to Greece, and, backed by Britain, the Greeks occupied this area. Kemal at once broke the Mudros Armistice 1918), and, after many defeats, at he battle of Sakaria (Sangarius) uccessfully held the Greeks. In this battle Anglo-Hellenism and the Treaty of Sèvres became politically extinct, and as a result of it France concluded a military and political alliance with Kemal.

France supported Kemal to the utmost with money, ships, and munitions, and ultimately, in Aug., 1922, he completely routed the Greeks at Afiun Qarahisar. The Greek army sustained enormous losses and fled in disorder, and in September the Greek government in Smyrna ended in a debacle. A meeting of the Allied generals and Kemalist representatives was held at Mudania in October, when the restoration to the Nationalists of Smyrna and all Anatolian territory, together with Thrace, was arranged.

These arrangements were incorporated in the Treaty of Lausanne (1923), which replaced the Treaty of Sèvres. (It is important to consult LAUSANNE, TREATY OF, where Turkish territorial losses are outlined.) During the European War Turkey regained from Russia the three sanjaks of Kars, Ardahan, and Batum, but by a treaty with the Caucasian states, signed at Kars in 1921, she returned Batum.

By the Fundamental Law passed in 1921 the Angora Government declared that all sovereignty was vested in the Turkish people, and that the legislative and executive power was vested in the Grand National Assembly elected by the people. This was the first step towards placing Turkey on a national instead of on a religious basis. In Nov., 1922, the Grand National Assembly declared that the office of Sultan had ceased to exist, and that the office of Caliph was to be held by a Prince of the House of Osman (chosen by election).

The Grand National Assembly at once took over the administration of Constantinople, and Sultan Mahommed V. fled. Prince Abdul-Medjid was elected Caliph, but in March, 1924, this office also was abolished, and the male members of the House of Osman were banished. In Oct., 1923, the Grand National Assembly proclaimed that Turkey was a republic, and Mustafa Kemal became President.

The Fundamental Law of 1921 became the republican Constitution, but this was revised in 1924 by a law which states that Turkey is a republic, Islam is the State religion, Angora is the capital, Turkish is the official language, and the Grand National Assembly (which elects the President, who in turn chooses a Council of Ministers) is the sole executive and legislative authority.

In 1925 a Kurdish rising under Sheikh Said caused great apprehension at Angora because, as its aim was to restore Islam to its former position in the state, it received much support throughout Turkey. It was decisively put down, however. Turkey was declared a republic in 1923, with Mustafa Kemal as President. He was re-elected in 1927, and under his guidance the country made great progress. Industry and agriculture advanced, and the position of women was raised to the European status. Western methods in government, education, and industry have been adopted. For Mosul dispute, *see* IRAK. *See* also ASIA MINOR; CONSTANTINOPLE; THRACE; TURANIAN.—BIBLIOGRAPHY: *Annual Report* on the Trade and Economic Relations of Turkey (H.M. Stationery Office); *Anatolia* (No. 59 in *Peace Handbooks*, vol. x., part i., of *Turkey in Asia*: H.M. Stationery Office), a general physical, economic, and historical survey; *Turkey in Asia* (No. 58, same series); *Armenia and Kurdistan* (No. 62), should also be consulted; Sir W. M. Ramsay, *Impressions of Turkey* and *The Historical Geography of Asia Minor*; Sir Edwin Pears, *Life of Abdul Hamid* and *Turkey and its People*; W. E. D. Allen, *The Turks in Europe*; Lord Eversley, *The Turkish Empire: its Growth and Decay*.

Literature. With the adoption of Islam, the Turks adopted also the Arabic alphabet, and thus, immediately after the conquest of Persia, fell under the sway of Persian literature. This influence lasted for more than 500 years, from about 1300 to about 1840. This is called the classical period, which is followed by the modern from 1840 onwards. The classical period can be divided into three phases: 1301-1520, where Persian influence is paramount; 1520-1730, the real classical period in which the most brilliant writers lived; and 1730-1840, the period of decay.

No fewer than 2200 writers have been enumerated by Hammer-Purgstall, who has published abstracts from them all. Out of 34 sultans no fewer than 21 were poets, some of great eminence, like Selim I. (1512-20), and many of the high officials and dignitaries were also poets of renown.

The modern literature is a complete break with the past, influenced by

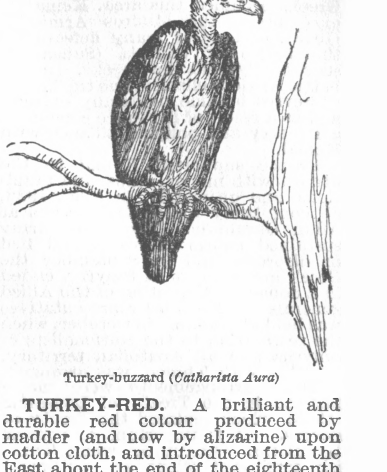
the romantic movement of the West and falling under the spell of French literature. It emancipates itself wholly from the old tradition and the old forms, and the Persian and Arabic elements are discarded.

The new writers and poets draw their inspiration overwhelmingly from French literature, although their vocabulary is pure Turkish. This literature serves also to awaken the national consciousness and effects a reinterpretation of Islam. Of the prominent leaders of the new movement are to be mentioned Namük Kemal (1837-88); Abdulhal Hamid (born 1852), romantic poet; Tewfik Fikret (1868-1914), purely of the Western school; Zia Gök Alp (born 1875), nationalist poet; Mehmed Emin (born 1869), popular poet; Mehmed 'Akif (born 1872); and Shinasi (1859). Among anthologies are that of Kafsade (1622), containing abstracts of 514 writers; and Ebuz-Ziya Tewfik, prose, 1886.—BIBLIOGRAPHY: Wells, *A Practical Grammar of the Turkish Language* (London, 1880); Kieffer and Bianchi, *Dictionnaire Turc-Français* (Paris, 1850); Hammer-Purgstall, *Geschichte d. osman. Dichtkunst* (4 vols., Pest, 1836-8). E. J. W. Gibbs, *History of Ottoman Poetry* (5 vols., 1900-8).

TURKEY. A large gallinaceous bird (*Meleagris gallopavo*), well known as an inmate of our poultry-yards. It is a native of North America, and was introduced into Europe in the sixteenth century. Wild Turkeys abound in some of the forests of America, where they feed on berries, fruits, insects, reptiles, etc., their plumage being a golden bronze, shot with violet and green, and banded with black.

On account of its size and the excellence of its flesh and eggs, the turkey is one of the most valued kinds of poultry. There is another species, the Honduras or West Indian turkey (*Meleagris ocellata*), which derives its specific name from the presence of bright eye-like spots on the tail-coverts. It is not so large as the common turkey, but its plumage is more brilliant.

TURKEY-BUZZARD, or TURKEY VULTURE. A rapacious bird belonging to the family of New World vultures (Cathartidæ) and the genus Cathartes (*C. aura*): so named from its bearing a distant resemblance to a turkey. It is about 2½ feet long, and with wings extended about 6 feet in breadth, general colour black or brownish, head and upper part of the neck scarlet. It inhabits a vast range of territory in the temperate and tropical parts of America. A closely allied species (*C. perniger*), native to the Amazon, is distinguished by its yellow head.



Turkey-buzzard (*Catharista Aura*)

TURKEY-RED. A brilliant and durable red colour produced by madder (and now by alizarine) upon cotton cloth, and introduced from the East about the end of the eighteenth century. The processes used in turkey-red dyeing are numerous, and vary in different establishments, but the most essential is the preliminary treatment of the fabric with oils or fats, combined with certain other substances, such as carbonate of potash or soda. Turkey-red dyed yarns are usually introduced into striped linen cloths, as the colour is proof against ordinary bleaching processes.

TURKEY-STONE. A very fine-grained siliceous slate. When cut and polished it is used for sharpening small cutting instruments.

TURKMEN. *See* TURCOMAN.

TURKS AND CAICOS. A British archipelago of the West Indies, a political dependency of Jamaica; area, 165½ sq. miles; pop. (1931), 5300. Grand Turk is the chief island; pop. 1570. In the Caicos group Cockburn Harbour is the chief settlement. Throughout the archipelago the day temperature is 78° F. (mean), and the wet season lasts from October to February. There are occasional hurricanes, but the group is healthy.

Steamships from New York to Santo Domingo call fortnightly at Grand Turk. Education is free and undenominational. The chief production is salt; some sponges from the Caicos Bank, dried conchs, and seashells are exported; cotton is grown.

Trade is almost entirely with the United States, and all foodstuffs are imported.

The people are of European and African extraction, and are all English-speaking. Until the end of the seventeenth century the archipelago was uninhabited, but was eventually visited by salt-rakers from Bermudas, who, with constant interference from the Spanish, carried on work for forty years. In 1799 the islands became a dependency of the Bahamas, but have been attached to Jamaica since 1848, although enjoying a certain measure of local government. *See* CAICOS ; JAMAICA.

TURKWEL. A river of Central Africa, rising in the crater-lake of Mount Elgon, and flowing over the floor of the Great (Eastern) Rift Valley towards Lake Rudolf, to the inland drainage system of which it belongs ; but it does not reach the lake, and is lost in the sands half a mile from the western shore.

Throughout its length the Turkwel forms the political frontier between Uganda and Kenya Colony. It receives the drainage of the Karamojo Plateau, and partly of the Sua Mountains (Kenya), and Mount Debasien (a horst, 10,050 feet altitude). The Kerut or Wei-Wei River is its only substantial tributary.

TURMERIC. The dried tubers or rhizomes of *Curcŭma longa*, nat. ord. Zingiberaceæ (ginger). It is largely employed in India and China as an important ingredient in curry powder. Unsized white paper, steeped in an alcoholic solution of turmeric, when dried, is employed as a test to detect alkalies, which change its colour from yellow to reddish-brown. Turmeric yields a yellow colour, which has great brightness but little durability.

TURNBERRY. A pleasure resort in Ayrshire, Scotland, on the coast, 5¼ miles from Girvan. It is a great golfing centre. Here are the ruins of a castle which once belonged to Robert Bruce.

TURNER, Joseph Mallord William. English landscape-painter, born in London 1775, died there 1851. The son of a hairdresser, he was first apprenticed to Thomas Malton, the architectural and topographical draughtsman ; and was also one of the group of young artists who copied from the drawings in Dr. Monro's collection. In 1789 he entered the Royal Academy as a student, and remained there for five years.

He first exhibited at the Academy in 1792, and was elected in 1799 an associate of the Royal Academy, and in 1802 a full Academician. Till this date he had chiefly been known as a landscape-painter in water-colours, but thenceforth he turned his attention to oil-painting, and in the ensuing half-century produced at the Academy exhibitions upwards of 200 pictures.

In 1807 he was elected professor of perspective in the Royal Academy, and the following year appeared his *Liber Studiorum* (Book of Studies), a series of engravings in mezzotint and etching inspired by Claude's *Liber Veritatis*.

Among other works by him which were engraved are his illustrations of Lord Byron's and Sir Walter Scott's poems, Rogers's *Italy* and *Poems*, *The Rivers of England*, *The Rivers of France*, and *Scenery of the Southern Coast*.

Up to about 1810 Turner's work was marked by great precision in execution and rather sombre colour, reflecting the influence of the Dutch landscape-painters and of the Poussins. Examples are : *The Windmill and Lock* (1806), *The Garden of the Hesperides* (1806), and *The Sun rising in Mist*. After 1810, under the influence of Claude, he showed the broader handling and greater atmospheric quality seen in *Hannibal crossing the Alps* (1812), *Apuleia in search of Apuleius* (1814), and *Crossing the Brook* (1815).

In 1819 a visit to Italy marks the beginning of a third phase, distinguished by imaginative quality, freedom in handling, and richer colour, and represented by *The Bay of Baiæ*, *Early Morning* (1826), *Dido* (1828), and *Ulysses deriding Polyphemus* (1829). A second visit to Italy in 1828 assisted towards the development of the richer colour of a fourth phase, and in 1839 *The Fighting Téméraire* inaugurated the final style, where Turner gives free rein to his imagination, and paints little but such visions in terms of light as *The Sun of Venice going to Sea* (1843), *Petworth*, and *Rain, Steam, and Speed* (1844).

By his will he bequeathed all his pictures and sketches to the nation, on condition of a suitable building being erected within ten years for their reception. A certain number are now in the National Gallery, the remainder being at the Tate Gallery. Turner's influence on landscape-painting has been very considerable. In particular, he contributed to the development of the Impressionist school in France.

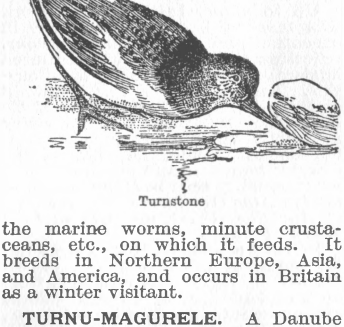
TURNHAM GREEN. District of London. To the west of the city, it is between Hammersmith and Chiswick, on the District Railway. The

green still remains an open space, but around the land has been built over.

TURNHOUT. A town of Belgium, in the province of Antwerp. It has manufactures of linen, woollen, and cotton fabrics, coloured paper, playing-cards, and liquor. Pop. (1931), 27,065.

TURNING. *See* MACHINE TOOLS.

TURNSTONE. A bird of the plover family (*Strepsilas interpres*). The length of the bird is about 9 inches. It takes its name from its practice of turning up small stones in search of



Turnstone

the marine worms, minute crustaceans, etc., on which it feeds. It breeds in Northern Europe, Asia, and America, and occurs in Britain as a winter visitant.

TURNU-MAGURELE. A Danube port of Rumania, capital of the department of Teleorman, 372 miles above Sulina, at the confluence of the Alt (Rum. *Oltu*) with the main stream; served by branch line to Costeti on the Wallachian Railway. It is opposite, and has ferry connection with, the Bulgarian fortress of Nikopol, and it makes grain shipments to Brăila. Industries include the manufacture of furniture, bricks, linen, aerated-water, and agricultural implements. Pop. 17,351.

TURNU-SEVERIN. A Danube port of Rumania, capital of the department of Mehedinti, 580 miles above Sulina; served by the Wallachian Railway (Craiova-Varciorova-Temisoara). It has railway repair-shops and Government shipbuilding-yards, where most of the Rumanian river vessels are made and repaired. At the abattoirs animals are slaughtered mainly for export to Central European countries. Cattle, preserved meat, cereals, petroleum, and leather are traded; the town is the seat of the Rumanian Custom House. Pop. 18,337.

TUR'PENTINE. A balsam obtained from various coniferæ by cutting the stems and collecting the sticky exudation. On distillation either with direct heat or with steam "oil of turpentine" passes over and a residue of colophony or common resin is left behind. American, French, and Venice oil of turpentine form the most important commercial varieties, and are obtained from various species of pine. They differ mainly in their behaviour towards polarised light.

Oil of turpentine is a colourless liquid with a pleasant odour, boiling-point about 160° C., specific gravity between 0·85 and 0·87. On exposure to air it becomes viscous and partly resinified. The chief ingredient is a terpene, known as pinene ($C_{10}H_{16}$). It is an excellent solvent for phosphorus, sulphur, iodine, etc., and also for resins; for this reason it is largely used in the preparation of paints and varnishes.

In medicine it is applied externally as a counter-irritant, but when inhaled or taken internally in large doses it is injurious. For certain purposes the commercial oil of turpentine is rectified by treatment with slaked lime and distillation with steam.

TURPENTINE TREE. The name given to some species of trees of the genus Pistacia, nat. ord. Anacardiaceæ, which yield turpentine, as the *P. Terebinthus*, the Chian or Cyprus turpentine tree, *P. lentiscus*, the Mount Atlas mastic or turpentine tree, etc. *See* PISTACHIO.

TURPIN, Dick. English robber, born at Hempstead, in Essex, in 1706, hanged at York in 1739. He was apprenticed to a butcher, but joined a gang of deer-stealers and smugglers. The gang frequently attacked lonely farm-houses and tortured the inhabitants.

In 1735 Turpin stole a horse in Epping Forest, and was traced to Whitechapel. He was on the point of being arrested when he accidentally shot his partner King and fled to Yorkshire, where he set up as a cattle-dealer. He was executed for horse-stealing.

Turpin was a commonplace scoundrel; there was no romance and much villainy in his actual career. He owes his celebrity to Harrison Ainsworth, who immortalised him in *Rookwood* (published 1834). This romance gives an account of his ride to York, on his mare Black Bess, undertaken in order to prove an alibi.

The legend of this ride has sometimes been connected with the highwayman John Nevison (hanged 1684), but it may be older still. At

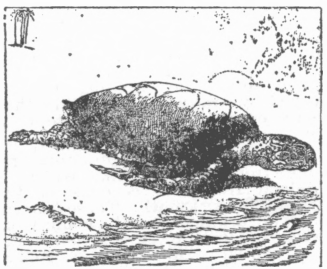
any rate, the story of Dick Turpin's ride was not extant until ninety-five years after he was hanged. Since 1834 numerous chap-books on the subject have appeared.

TURQUOISE (tur'koiz). A greenish-blue opaque precious stone, consisting essentially of a hydrous phosphate of alumina, containing a little oxide of iron and oxide of copper. The true or Oriental turquoise, a favourite ornamental stone in rings and other articles of jewellery, is found only in a mountain region of Persia, and was originally brought into Western Europe by way of Turkey (hence the name).

TURRIFF. Burgh of Aberdeenshire. It is 34¾ miles north of Aberdeen and is served by the L.N.E. Railway. Pop. (1931), 2298.

TURTLE. The name given to the marine members of the order Chelonia, reptiles with paddle-like limbs, and differing but little from tortoises, the name turtle or tortoise being in some cases applied indifferently. They are found in all the seas of warm climates. The most important species is the green turtle (*Chelone mydas*), which is from 6 to 7 feet long, and weighs from 700 to 800 lb. The food mostly consists of marine plants.

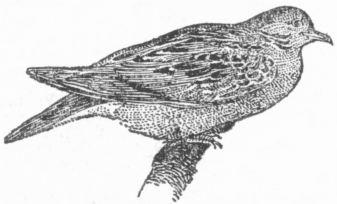
Its flesh is highly esteemed as a table luxury. It is a native of the tropical parts of the Atlantic as well



Hawk's-bill Turtle

as of the Indian Ocean, being especially abundant near Ascension Island. The carnivorous logger-head turtle (*C. caretta*) yields an oil which is used for lamps and for dressing leather. The hawk's-bill turtle (*C. imbricāta*), another carnivorous species, is remarkable for the beautiful imbricated horny plates covering the carapace, and constituting the tortoise-shell of commerce. A large one yields as much as 8 lb. *See* TORTOISE.

TURTLE-DOVE (*Turtur commūnis*). A small variety of pigeon, about 11 inches in length, colour pale-brown marked with a darker hue above, a purple tinge pervading the feathers of the breast. They are in general smaller and more slender than the domesticated pigeons, and their cooing note is plaintive and tender.



Turtle-dove

Turtle-doves winter in Northern Africa and Western Asia, migrating to Europe (including Britain) late in April.

TURTON. An urban district and town of Lancashire, England. There are cotton-mills, paper-factories, print-works, bleach-works, etc., and power and water is supplied from Bolton. Pop. (1931), 11,847.

TURTUCAIA, or TUTRAKAN. A town of Rumania, in the Dobruja, on the Danube. It is a Danube fishing-centre, and has a trade in cereals. Turtucaia has figured much in history, especially during 1912-3 (London Congress and Treaty of Bucharest), and during the European War, when (6th Sept., 1916) it was occupied by the left wing of the Bulgarian army six days after the entry of Rumania into the war. Pop. 11,103.

TUSCALOOSA. A city of Alabama, United States, the county seat of Tuscaloosa county, on Black Warrior River; served by the Mobile & Ohio, and the Alabama Great Southern Railways. It is an educational centre, with the University of Alabama (founded 1820), and several colleges, and the adjacent district is engaged in coal and iron industries. Founded in 1815, Tuscaloosa became a city in 1819, and was state capital (for twenty years) until 1846. Pop. (1930), 20,659.

TUSCAN ORDER OF ARCHITECTURE. One of the five orders of architecture, according to Vitruvius and Palladio. It admits of no ornaments, and the columns are never fluted. Otherwise it differs so little, however, from the Doric, that it is generally regarded as being only a variety of the latter. *See* DORIC ORDER.

TUS'CANY (It. *Toscana*). A maritime compartimento of North-Western Italy, comprising the provinces of Arezzo, Firenze, Grosseto, Livorno,

Lucca, Massa e Carrara, Pisa, Pistoia, and Siena ; area, 8853 sq. miles ; pop. (1931), 2,892,364. It is traversed north and east by the main range and by spurs of the Etruscan Apennines, and is generally hilly. The Arno is the chief river, and the Arno Valley with its peneplanes forms the richest agricultural region of Tuscany.

Cereals, wine (*Chianti*), tobacco, oil, chestnuts, and flowers are produced, and horses and cattle are grazed on the coastal plain (Maremma). The Maremma (850 sq. miles) was at one time a malarial deathtrap. The wealth of Tuscany lies in its minerals, which include lignite, alabaster, marble, iron, mercury, copper, and salt. There are springs (mineral and hot) at Montecatini and Bagni di Lucca. Florence is the chief town, Leghorn the chief seaport, and Florence, Pisa, and Siena are art centres.

Tuscany corresponds to the ancient *Etruria* (q.v.), which was, however, of wider extent. After the fall of the Western Empire (A.D. 476) it passed successively into the hands of the Ostrogoths, Byzantine Greeks, and Lombards. Charlemagne made it a Frankish province, and it was governed by marquesses or dukes until the twelfth and thirteenth centuries, when it became broken up into a number of small republics, four of which were Florence, Pisa, Siena, and Lucca.

From the first Florence occupied the leading place, and it gradually extended its territory. Dante, Giotto, Petrarch, and Boccaccio made Tuscany famous in the revival of arts and letters in the fourteenth century, and the Tuscan dialect became the literary language of Italy. In 1569 Pope Pius I. granted to Cosmo I. the title of Grand-Duke of Tuscany, and this position was retained, with interruptions, by the Medici family until 1737, when it passed to Francis Stephen, duc de Lorraine. In 1859, when under his descendant, the Grand-Duke Leopold, it was annexed to Sardinia by a popular vote, and in 1861 became, with Sardinia, part of the Kingdom of Italy.

TUS'CULUM. An ancient city of Latium, of which the ruins are found about 1½ miles north-east of modern Frascati (Italy) and 15 miles south-east of Rome. It stands among the Alban Hills at an altitude of about 2000 feet, and is traditionally older than Rome itself, having been founded by Telegonus, son of Odysseus and Circe. In the time of Tarquinius Superbus, Octavius Mamilius of Tusculum married Tarquin's daughter, and the alliance of Mamilius with Tarquin was the main cause of the Latin War, during which Mamilius was killed.

Towards the end of the Republic Tusculum was one of the favourite resorts of wealthy Romans, but, unlike *Tibur*, it did not apparently appeal to the poets. In form the city comprised a lower region or town dominated by an isolated arx or citadel, which towered on the topmost peak above. Tusculum was the birthplace of the elder Cato.

TUSSAC, or **TUSSOCK-GRASS** (*Dactylis cæspitōsa*). A large grass of the same genus as the cock's-foot grass of Britain, a native of the Falkland Islands, Fuegia, and South Patagonia. It grows in great tufts or tussocks sometimes 5 or 6 feet in height, the long tapering leaves hanging over in graceful curves. The plant is a useful food for cattle, and several attempts have been made to establish it in Scotland.

TUSSAUD, Madame Marie. Effigist, born in Berne in 1760. She learned the art of wax modelling in Paris. She had opportunities for becoming acquainted with many leading persons through the lessons in modelling that she gave to Elizabeth, a sister of Louis XVI. In 1802 she established herself in London, gradually building up the famous waxwork show in Baker Street. Her portraits were always lifelike, and "Madame Tussaud's" is one of the sights of London. She died 16th April, 1850, and the show is now owned by her descendants. The building was destroyed by fire in 1925, and was then re-erected upon a larger scale than ever.

TUSSORE. A fabric probably first made from Tussah silk, which is obtained from the cocoons of the Tussah (Tusser) moth. These fabrics, however, are now mostly made from mercerised cotton yarns. *Shantung* is a similar, comparatively rough-surfaced cloth, still made in China and India, but frequently imitated.

TUTANKHAMEN. One of the last three kings of the XVIIIth dynasty of ancient Egypt. He gained his title to the throne by marrying the third daughter of Akhenaten, whose second daughter had died at birth, and whose eldest daughter had married Sakere (*see* TELL AL-AMARNA). Tutankhamen succeeded Sakere. The royal marriages of ancient Egypt were contracted by both parties at an early age, and Ankhesenamen seems to have married Tutankhamen when she was only twelve years of age.

Kings, it is thought, came of age at sixteen, but experts disagree re-

garding the actual age of Tutankhamen at his accession. His tomb in the Valley of the Kings was discovered by Lord Carnarvon and Mr. Howard Carter, and was officially opened on 29th Nov., 1922; but among the contents there appears to have been nothing whatever that would indicate the king's manhood. All of the articles found, including a magnificent painted wooden mannikin in the king's likeness, and used as a sort of tailor's dummy, point to the fact that Tutankhamen at his death was a mere boy. If this be granted, the religious changes effected during his short reign became extraordinary.

The fine throne or chair of State bears in only one place his early title Tutankhaten. Elsewhere "Tutankhamen" is the rule. The actual entrance to the tomb of Tutankhamen was discovered on 5th Nov., 1922, and the tomb itself consists of an antechamber approached by two short flights of stairs. On the right of the antechamber is the door of the shrine or inner chamber, which was guarded by two large statues. This chamber was first opened on 16th Feb., 1923.

Early in 1924 the sarcophagus in which the Pharaoh lay was discovered in the innermost of three shrines. There was a disagreement between Mr. Carter and the Egyptian Government in Feb., 1924, and the Egyptian Government officially opened the tomb on 6th March, 1924. The inner coffin was opened on 13th Nov., 1925, revealing the mummy of a fifteen-year-old boy.

TUTBURY. Town of Staffordshire. It is 4¼ miles from Burton-on-Trent, and 140 from London by the L.M.S. Railway. Standing on the Dove, it has an agricultural trade. It is known for its castle, now a ruin, in which Mary Queen of Scots was imprisoned. The parish church is a fine building, the Norman doorway being specially notable. The castle and the surrounding land is the property of the Duchy of Lancaster. Pop. 2062.

TUTICORIN'. A seaport-town of Madras province, India, in Tinnevelly district; the southern terminus of the South Indian Railway, and the centre of a large passenger traffic with Ceylon. It is an important commercial city, ranking second in the province and among the first ten in all India. Pop. 44,522.

TUTOR. (1) At Oxford, Cambridge, and Dublin, a graduate (almost invariably a Fellow of his college), to whom the special supervision of an undergraduate is assigned. At Oxford a tutor's main duty is to look after his pupils' studies; at Cambridge he is more concerned with the social and economic welfare of his pupils. (2) In Scots law, the guardian of a boy or girl in pupilarity. By common law a father is tutor to his children. Failing him there may be three kinds of tutor, a *tutor-nominate*, a *tutor-at-law*, or a *tutor-dative*.

TUTTLINGEN. A town of Württemberg, on the Danube. It manufactures surgical and scientific instruments, leather goods, woollens, and beer. Pop. (1925), 16,281.

TVER. A province of the Russian S.F.S.R. It has an area of 25,000 sq. miles, and a population of 2,250,000. Rye, barley, hemp, and flax are produced, and the forests are extensive.

TVER. A city of Soviet Russia, capital of the province of Tver, situated in a plain on the Volga, 96 miles north-west of Moscow. Manufactures are mainly confined to cottons. Dating from 1181, Tver was the capital of an independent principality from the thirteenth century to the end of the fifteenth. Pop. 106,337.

TWAIN, Mark. Pen-name of Samuel Langhorne Clemens, American humorist and author. He was born at Florida, Miss., 30th Nov., 1830. In turns printer, river pilot, miner, and journalist, he gained fame overnight with *The Celebrated Jumping Frog of Calaveras County*, the result being that he was commissioned in 1867 by a San Francisco paper to write letters descriptive of a European trip. These were published under the title of *The Innocents Abroad* and had a prodigious sale, as did also *A Tramp Abroad*, published 1880. Among many other works were *The Prince and the Pauper*, *Tom Sawyer*, *Huckleberry Finn*. He died 21st April, 1910.

TWEED. A river of Scotland, which rises in the south part of Peeblesshire, passes by or near to Peebles, Melrose, Kelso, and Coldstream, from near which place it forms the boundary line between England and Scotland for 16 miles, runs through England for a short distance, and then enters the North Sea at Berwick-on-Tweed; total length, 97 miles. Its tributaries include the Ettrick, Gala, Leader, Teviot, Eden, and Till. Its waters abound with salmon and trout, and its name is celebrated in connection with some of the best literature of Scotland.

TWEEDMOUTH. A town of Northumberland, England, on the south bank of the Tweed, near its mouth, opposite Berwick-on-Tweed, in which borough it is. Pop. 2892.

TWEEDS, or **TWEED,** in reference to textiles, is the name applied exclusively to woollen goods which are made from multi-coloured materials. The various colours constituting the fabric may be due to the admixture of several differently coloured wool-dyed fibres with some body colour, to yarns of different colours twisted together, or to two or more self-coloured yarns arranged in some predetermined order in the warp, in the weft, or in both, so as to form a pattern. It should be remarked that the pattern owes as much of its actual effect to the colour scheme of the threads as to the weave employed.

The etymology of the word *tweed* is doubtful; but since practically all so-called tweeds are woven by twill weaves, and since the Scottish equivalent in some districts for twill is tweel,[1] it seems quite likely that the word tweed, as applied to fabrics, owes its origin to a badly formed "1" in the word tweel. The word twill simply means that the simple directional ornament formed by the intersecting of the warp and weft yarns runs diagonally, and usually at about 45°, from selvage to selvage of the cloth.

Originally, real tweeds were made of yarns composed of wool and wool alone, but the term is now a little more elastic, for a considerable number of so-called tweeds are made wholly or partially from remanufactured products such as waste, mungo, and shoddy.

A real Scotch tweed, however, should be, and probably always is, made from pure wool, and so are the Harris tweeds and many of the Yorkshire and other tweeds. The admixture of colours to black and white bases, including all shades of grey, and of different kinds of fibres, has become a fine art, and considerable difficulty is experienced in detecting any type of adulteration (unless such adulteration is excessive) except by scientific analysis.

Indeed, one is often advised to choose his colours and trust his tailor for the rest. The chief use for tweeds was, for some time, for men's suits; their use has now been extended to mid-weight overcoats, to several types of garments for ladies, and to sports suits. They are also found adapted for the lighter kinds of travelling-rugs and for several types of decorative textures.

TWELFTH-DAY. The twelfth day after Christmas, upon which is held the festival of Epiphany (q.v.). On the evening of this day, called Twelfth night, various social rites and ceremonies are, or were, observed in different countries. One of these is the baking of a twelfth-cake, into which a bean is introduced. When the cake is divided at the feast, the person who receives the piece containing the bean is made king for the occasion. In Italy it is customary to give presents to children on this day.

TWICKENHAM. A municipal borough and residential suburb of Greater London, in the county of Middlesex and on the Thames. In last century it was a fashionable resort, and has numbered among its residents Queen Anne, Horace Walpole, Charles Dickens, Tennyson, and Alexander Pope. Pop. (1931), 39,909.

TWILIGHT SLEEP. Obstetric method. It produces a state of insensibility to pain and partial unconsciousness by the use of the drug scopolamine-morphine. By this means it is claimed that the mental and physical pains of childbirth may be removed or prevented without any injurious after-effects.

TWILL. A technical term indicating the method of interlacing the warp with the weft in a textile fabric. There are hundreds of different kinds of twill fabrics, each of which can be represented in a simple manner. Thus one of the commonest twills is the 2 up, 2 down twill, and this may be symbolically represented by $^{2}/_{2}$. Similarly a 4-leaf weft swansdown, 1 up and 3 down, is denoted by $^{1}/_{3}$, while the symbol $^{2}/_{2}{}^{1}/_{7}$ means a fancy twill repeating on 12 threads or picks with 2 up, 4 down, 1 up, 5 down, and so on.

TWISS, Sir Travers. British jurist, born in Westminster in 1810, died in 1897. Educated at University College, Oxford, he became a Fellow and tutor of his college; was appointed successively professor of political economy at Oxford (1842-9); professor of international law, King's College, London (1852-5); professor of civil law in Oxford (1855-70); and Advocate-General of the Crown (1867-72). He wrote many books dealing with international law and kindred topics.

TWYFORD. Village of Berkshire. It is 33¾ miles from London by the G.W. Railway, on which it is a junction. Pop. 1437. There is a village of the same name near Winchester, which is 66¾ miles from London by the Southern Railway. Pop. 2214.

TYBURN. A turnpike at the west end of Oxford Street, London, noted for the public executions of metro-

[1] In *Guy Mannering*, when "Captain Brown" asks Mrs. Dinmont for "just such a grey plaid as the goodman wears," he was promised "as gude a tweel as ever cam aff a pirn" (chap. xxvi.).

politan malefactors which long took place near it. The turnpike was removed in 1829.

TYLDESLEY. A town of Lancashire, England. Its chief industries are cotton-spinning and coal-mining. Pop. (1931), 14,848.

TYLER, Wat. English rebel, and principal leader of the English social revolt of 1381. He was a man of obscure origin, but he is supposed to have come either from Kent or Colchester in Essex. He led the men of Kent upon London, where, after fire and pillage, they were partly dispersed by a promise of the king to grant them charters of freedom and amnesty. Tyler, however, remained with a body of the insurgents, and was met by the king next day at Smithfield, where, for his apparent insolence in the royal presence, he was stabbed by William Walworth, Mayor of London.—Cf. Sir Charles Oman, *The Great Revolt of 1381.*

TYLOR, Sir Edward Burnett. British anthropologist, born at Camberwell 1832, died 1917. He devoted himself with much success to researches in the history of man and civilisation; was president of the Anthropological Society, keeper of the Oxford University Museum, and reader in anthropology. First Gifford lecturer at Aberdeen in 1888, he was appointed professor of anthropology at Oxford in 1896. He was made F.R.S. in 1871, and was knighted in 1912. His chief works are: *Researches into the Early History of Mankind, Primitive Culture, Anthropology: an Introduction to the Study of Man and Civilization*, etc.

TYNDALE, William. English translator of the Bible, born about 1490 in Gloucestershire, died in 1536. Educated at Oxford, he took orders and went as a tutor to Gloucestershire, where, in consequence of his opinions in favour of the Reformation doctrines, he was reprimanded by the chancellor of the diocese. He then removed to London, where he probably began his English version of the New Testament, and subsequently proceeded to Germany, visiting Luther at Wittenberg.

Having completed his translation, he got it partly printed in quarto at Cologne; but he had to flee from this town, and the complete work was printed in octavo at Worms.

The greater part was sent to England, and the prelates Warham and Tunstall collected all copies they could seize or purchase, and committed them to the flames. The only fragment of the quarto edition known to exist is preserved in the British Museum.

Of the first octavo edition only two copies remain, one in the Baptist College at Bristol, the other (imperfect) in the library of the Chapter of St. Paul's. Revised editions were soon issued by Tyndale himself. Tyndale also translated the *Pentateuch*, and subsequently Jonah.

In 1530 he took up his residence at Antwerp. In 1535 he was thrown into prison at Vilvorde, near Brussels, and being found guilty of heresy, he was strangled and his body burned at the stake. Tyndale's translation of the Scripture is distinguished by its perspicuity and noble simplicity of idiom.—Cf. G. B. Smith, *William Tyndale and his Translation of the English Bible.*

TYNDALL, John. British physicist, born in 1820 in County Carlow, Ireland, died 1893. He joined the Irish Ordnance Survey in 1839, and was transferred to the English Survey in 1842. In 1847 he was appointed teacher in Queenwood College, Hants, then went abroad, where he studied under Bunsen in Marburg University and Magnus in Berlin.

He was elected to the chair of natural philosophy in the Royal Institution in 1853; visited Switzerland in 1856 along with Huxley, and made repeated investigations in that country subsequently. He lectured throughout the United States in 1872, presided over the British Association in 1874 at Belfast, and was for several years adviser on lighthouses to the Board of Trade.

His chief works are: *The Glaciers of the Alps* (1860); *Mountaineering in 1861* (1862); *Heat considered as a Mode of Motion* (1863); *On Radiation* (1865); *Sound* (1865); *Faraday as a Discoverer* (1868); *Light* (1870); *Researches on Diamagnetism and Magne-Crystallic Action* (1870); *Hours of Exercise in the Alps* (1871); *The Forms of Water in Clouds, Rivers, Ice, and Glaciers* (1872); *Fragments of Science* (1876); *Fermentation* (1877); and *Floating Matter in the Air in Relation to Putrefaction and Infection* (1881).

TYNE. A river of England, formed by the junction near Hexham of the North Tyne, which rises in the Cheviots, on the borders of Roxburgh, and the South Tyne, which rises at Tynehead Fell, in the extreme east of Cumberland. The united stream divides the counties of Durham and Northumberland, passes the ports of Newcastle, Jarrow, and North and South Shields, and enters the sea at Tynemouth after a course from Hexham of nearly 30 miles.

From the sea to Scotswood suspension-bridge, a distance of about 10 miles, the river is navigable for large vessels; the trade on the river, chiefly in coal, is immense; and the whole of the Lower Tyne Valley is a busy industrial region.—Cf. A. J. Sargent, *The Tyne* (*Geographical Journal*, vol. xl. (1912), pp. 469-86, with maps, etc.).

TYNEMOUTH. A municipal borough and port of England, in the county of Northumberland, at the mouth of the Tyne. There are ruins of a picturesque old priory, an aquarium, winter-garden, baths, etc., and the place is much frequented for sea-bathing. The port of North Shields and several villages are included within the borough, which returns one member to Parliament. Pop. (1931), 64,913.

TYPE. A small rectangular block, usually of metal or wood, having on its upper end a raised letter, figure, punctuation mark, or other character, for use in printing (q.v.). Large types for posters are cut from close-grained wood like that of the box or maple.

Point Sizes	Old Names
5-point	(Pearl)
5½-point	(Ruby)
6-point	(Nonpareil)
7-point	(Minion)
8-point	(Brevier)
9-point	(Bourgeois)
10-point	(Long-primer)
11-point	(Small-pica)
12-point	(Pica)
14-point	(English)
18-point	(Great-primer)

Types for book and newspaper printing are made from an alloy of melted lead, tin, antimony, and sometimes copper, that fills the mould exactly and shrinks but little in cooling. The beauty of text-types being in their precision, the letters on the steel punches from which types are cast must be uniform in style—height, line, stroke, serif, curve, and angle; they should be in proper relative proportion as to size, and as to nearness and distance in all combinations.

William Caslon (1692-1766), the great English type-founder, was very successful in observing these conditions. In France Pierre Simon Fournier (1712-68) rendered a great service to typography by the invention of the system of "typographic points," for determining the sizes and proportions of types. F. A. Didot (1730-1804) perfected this system. In Britain the old names given below are now falling into disuse, owing to the success of mechanical type-setting machines which have adopted the point system, 1 point being about the seventy-second part of an inch.

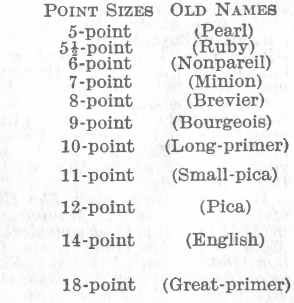
The assortment of characters known as a fount or roman book-type requires the engraving of 150 punches:

28 large capitals, including Æ and Œ;
28 small capitals, including æ and œ;
33 lower-case characters, including fi, fl, ff, ffi, ffl, æ, and œ;
19 figures and fractions;
22 points, references, and signs;
20 other characters.

It is not desirable in good printing to mix the styles of type used in a book, but with the italic of the series the compositor can make use of six variations in each size, as thus:

ROMAN CAPITALS.
ITALIC CAPITALS.
ROMAN CAPITALS AND SMALL CAPITALS
ROMAN SMALL CAPITALS.
Roman lower-case. *Italic lower-case.*

Actual Sizes of Letters

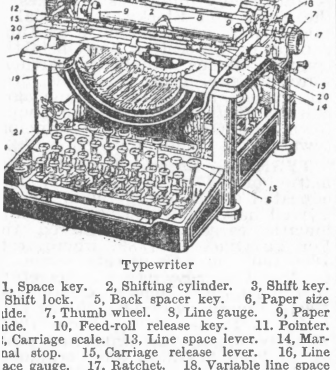


Bibliography: T. L. De Vinne, *Plain Printing Types*; D. B. Updike, *Printing Types* (2 vols.).

TYPEWRITER. A machine which writes characters similar to those produced by printers' types. The first practical typewriter was made from a patent by C. L. Sholes, by Messrs. E. Remington & Son, Ilion, New York, in 1873. The paper is clamped to a cylinder, mounted on a sliding carriage which can be moved to any horizontal position. When the typist releases a key the carriage moves to the left a distance equal to the breadth of a letter. An alarm bell is automatically rung when nearing the edge of the paper or any prearranged stopping place.

The cylinder is rotated by a lever

give the desired spacing between
:h line, and adjustable stops are
)vided to govern the lever action.
e inking ribbon is carried on two
)ols, and is automatically unwound
d wound until the ink is removed
the types. The ribbon is placed
tween the type and the paper, and
ıen the keys are depressed the
aracters, by means of a combina-
n of jointed levers, transfer the
k to the paper. Each key is marked
th the character it represents and



Typewriter

1, Space key. 2, Shifting cylinder. 3, Shift key. Shift lock. 5, Back spacer key. 6, Paper size ıde. 7, Thumb wheel. 8, Line gauge. 9, Paper ıde. 10, Feed-roll release key. 11. Pointer. ', Carriage scale. 13, Line space lever. 14, Mar- nal stop. 15, Carriage release lever. 16, Line ace gauge. 17, Ratchet. 18, Variable line space ck. 19, Marginal release. 20, Final stop release ver. 21, Column selector key.

arries two forms of the character, g. a capital and a lower-case letter. o move the paper under the desired)rm a shift key is provided at each de of the keyboard. The levers arrying the types radiate from a entral point called the writing point.

TYPHA'CEÆ. A natural order of ıonocotyledonous plants, character- ed by their calyx being three- :palled and half-glumaceous, or a ıere bundle of long hairs, by their)ng lax filaments, clavate anthers,)litary pendulous ovules, and pecu- ar habit. The order includes two enera, Typha and Sparganium, the pecies of which are abundant in the orthern parts of the world. They re herbaceous reed-like plants, grow- ıg in marshes and ditches. *See* REED- MACE.

TYPHLOPS. The type genus of a ımily (Typhlopidæ) of blind burrow- ıg snakes that feed on insects. They re tropical and subtropical forms with wide distribution. *T. vermicularis* ı native to the Balkan Peninsula and outh-West Asia.

TYPHOID-FEVER. *See* ENTERIC FEVER.

TYPHOON'. A name applied to tropical cyclones in the China Sea. They originate generally south of 10° N. lat., and are seldom encountered north of 50° N. lat. Taking origin east of the Philippines (where they are known as *baguios*), they shape a west-north-west course, sweeping the coasts of the China Sea, and then being deflected north-east to Japan, etc. In the centre or eye of the storm there is an absolute calm, and it is this death-trap that mariners must study to avoid. In the eye the barometric pressure is at its nadir, and overhead there is a patch of clear blue sky.

Typhoons occur mostly during the change of monsoon, and between June and November, although September is the most prevalent month.

Etymologists differ in some respects regarding the etymology of the word typhoon. The German term is *teifun*, and is derived from the Chinese *tai fung*, meaning literally big wind. According to Murray, the English word is derived from the Urdū *tūfān*, a violent storm of wind and rain, and may represent the Greek *typhon*, which is the earlier English designation of these storms.

TYPHUS FEVER (also called exanthematic typhus, jail, camp, or ship fever). An acute infectious disease, characterised by a spotted rash, extreme physical prostration, and marked mental confusion. It is now rarely seen in Great Britain, and it may fairly be claimed that it has been stamped out by modern sanitation. This has been brought about by improvement of dwelling-houses, opening up congested areas, destruction of slum property, and the compulsory notification of infectious diseases.

The disease is still common in Eastern Europe, and in the East, and is from time to time imported to Western countries by immigrants. It became more widespread during the European War (1914-8), and is still epidemic in wide districts in East Europe. Epidemics occurred in Arabia and Mesopotamia during the war. The disease is always associated with overcrowding, insufficient airspace, dirt, and destitution.

The onset of the disease is very sudden, beginning with severe headache and well-marked chilliness, while vomiting and nausea occur in most cases. As the temperature rises the usual symptoms of fever appear, but the mental acuteness of the patient is blunted in a marked manner from the onset, and his appearance, with congested face, stupid

expression, pink and watery eyes, is most suggestive.

Prostration is a marked feature from the outset. By the fourth day of the disease the rash appears, and there is a distinctive and very unpleasant odour from the patient, which is compared to the smell of mice. The fever lasts for about a fortnight, and ends by a crisis of two to three days duration, followed by a lessening in severity of all the symptoms, with resulting convalescence and recovery; or during the fortnight, usually in the second week, the symptoms become more severe, with delirium, and the patient dies.

Treatment rests with good and careful nursing; special care is directed to the dangers of exhaustion and the effects of the delirium. Isolation of the patient and of contacts is necessary to prevent the spread of the disease. The chances of recovery in children are greater than in adults, and it is extremely fatal in old age.

TYPOGRAPHY. *See* PRINTING and TYPE.

TYR (Ice. *Týr*, etymologically connected with Gr. *Zeus*, and Lat. *deus*). The Scandinavian name of a one-armed Teutonic deity, represented in the *Eddas* as the son of Odin, and god of war. He was the bravest of the gods, and lost his arm by placing it in the mouth of the wolf *Fenrir* as a hostage, while being tied up by an unbreakable cord. Tyr is called *Tiw* in Anglo-Saxon, whence *Tiwes daeg*, or Tuesday.

TYRAN'NUS. the type-genus of an American family (Tyrannidæ) of perching birds. The best-known species is the king bird (*T. carolinensis*), which is remarkable for its bold and pugnacious disposition. It is a native of the United States, feeds on insects, and is not afraid to attack birds of prey much larger than itself. It is also called *tyrant-shrike*.

TYRE. One of the most celebrated cities of ancient Phœnicia, and with its elder sister, Sidon, long a great trading mart. It was built partly on an island and partly on the mainland; and the insular fortifications formed its chief strength when besieged and taken by Alexander the Great in 332 B.C. A mole or causeway then constructed to the island was the origin of the isthmus which now connects it with the mainland.

Tyre was famous in the tenth century B.C. under Hiram, the friend of Solomon, was besieged in vain by the Assyrians from 725 to 720 B.C., and by Nebuchadnezzar from 585 to 572 B.C., and remained an important place till it came into the hands of the Turks. It was famous for a dye (the Tyrian purple) obtained from the shell-fish Murex (q.v.). The modern Tyre of Sur is a place of 5000 inhabitants (3000 Christians). *See* PHŒNICIA.

TYROL'. *See* TIROL.

TYRONE. A county of Ulster, Northern Ireland, bounded on the east by Lough Neagh; area, 79,563 acres. The surface is hilly, rising into mountains in the north and south, and declining to a level towards Lough Neagh; and the county is watered by numerous branches of the Foyle and Blackwater. Coal is raised to a small extent near Dungannon in the eastern portion of the county; linens, woollens, earthenware, whisky, beer, chemicals, etc., are made; and there is some agriculture. Strabane, Dungannon, Cookstown, and Omagh are the principal towns. Pop. (1926), 132,792.

TYRRELL, Baron. English diplomat, born 17th Aug., 1866, and educated at Oxford, William George Tyrrell has had a distinguished diplomatic career. He entered the Foreign Office in 1889, where from 1896-1903 he was private secretary to the Under-Secretary; secretary to the Imperial Defence Committee, 1903-4; acting-secretary to the Embassy in Rome, 1904. From 1907-25 he occupied other important posts at the Foreign Office, was Permanent Under-Secretary from 1925-8, and since then he has been British Ambassador in Paris.

TYRRHENIAN SEA. The name given to that part of the Mediterranean Sea which is enclosed between the Islands of Corsica and Sardinia on the west, the Italian Peninsula on the east, and Sicily on the south.

TYRTÆUS. Greek elegiac poet, famous chiefly for his war-songs. It is usually believed that he lived in the seventh century B.C., though Verrall places him in the fifth century, while some scholars deny his existence outright. It is uncertain whether he was an Athenian or a Spartan; the tradition which connects him with the Attic deme of Aphidnæ may have been inspired by the desire of the Athenians to monopolise all literary merit.

According to the current legend, he assisted the Spartans in the second Messenian War by means of writing martial elegies and marching-songs. According to a later legend, he was a lame schoolmaster, sent from Athens in fulfilment of an oracle, and chosen on account of his ignorance of soldiering.

The extant poems of Tyrtæus are noble and spirited. One of the best known has been translated by Thomas Campbell. Müller says: "When the Spartans were on a campaign it was their custom, after the evening meal, when the pæan had been sung in honour of the gods, to recite these elegies of Tyrtæus. They were, however, never sung on the march of the army and in the battle itself; for these a strain of another kind was composed by the same poet, viz. in the anapæstic marches."

TYRWHITT, Admiral Sir Reginald Yorke. British sailor; born 10th May, 1870, he became lieutenant on H.M.S. *Cleopatra* in 1894. In the Great War he commanded destroyer flotillas near Heligoland, and was in action off the Dogger Bank. In 1921-2 he commanded the third light-cruiser squadron in the Mediterranean, was commanding officer of the Coast of Scotland, 1923-5, and commander-in-chief of the China station, 1927-29. He was promoted to the rank of admiral in 1929, and has been commander-in-chief at the Nore since 1930. He was created baronet in 1919 and made G.C.B. in 1929.

TYRWHITT, Thomas. English Chaucerian and classical scholar; born in 1730, and died in 1786. He was educated at Eton and Queen's College, Oxford, becoming a Fellow of Merton in 1755. He was called to the Bar at the Middle Temple, became Deputy-Secretary at War (1756-62), and Clerk of the House of Commons (1762-8). From 1768 onwards he lived a life of learned retirement. He was an accomplished classical scholar, edited two fragments of Plutarch, wrote a dissertation on the fables of Babrius, and gathered material for a most valuable edition (posthumously published) of Aristotle's *Poetics*.

His fame, however, rests mainly upon his edition of Chaucer, which was published in four volumes in 1775; the fifth volume, containing a glossary, appeared in 1778. Tyrwhitt is the earliest and greatest of Chaucerian scholars; as an English scholar he is worthy to be compared to Porson as a Grecian. No single man has done as much for Shakespeare as Tyrwhitt has done for Chaucer. He was singularly well fitted to edit Chaucer, as he had a wide knowledge of classical and mediæval literature, a correct ear, and a sense of poetry, and was "rich in saving common sense."

He purged the works of Chaucer of much foreign matter, corrected the text, elucidated many difficulties, and pointed out "the pronunciation of the feminine *-e*." He thus restored to Chaucer, in part at any rate, his grace of language and metre. He was a man far in advance of his age; his edition of Chaucer is a real masterpiece of scholarship. His knowledge and his diligence are so great that the gratitude of later editors to him is somewhat tempered by feelings which make them cry "Pereant qui ante nos nostra dixerunt."

TYTLER, Patrick Fraser. Fourth son of Alexander Fraser Tytler (Lord Woodhouselee); born at Edinburgh in 1791, and died in 1849. In 1813 he was admitted a member of the Faculty of Advocates, but abandoned the Bar for literature, and wrote his great work *The History of Scotland* (1823-43). Among his other works are his biographies of the Admirable Crichton, Wycliffe, and Sir Walter Raleigh.

U

U. The twenty-first letter and the fifth vowel in the English alphabet. Its true primary sound was that which it still retains in most of the languages in Europe, that of *oo* in *cool, tool, good, wood,* etc., answering to the French *ou* in *tour,* the sound being sometimes short, sometimes long.

UBANGI. A river of Africa, a right-bank tributary of the Congo. It is formed by the confluence of the Welle (Uele) and Bomu (Mbomu), both rising in the Congo-Nile watershed, and joins the Congo by a delta of five mouths, after a course of over 700 miles. The Uele is the southern fork of the Ubangi, and the Ubangi-Uele system has a length of approximately 1470 miles.

For the whole of its length the Ubangi forms the frontier between the Belgian Congo and French Equatorial Africa, the boundary being continued by the northern fork, the Bomu. Among tributaries the Bomokandi (left-bank affluent of the Uele) is the most important. The Uele was discovered by Schweinfurth in 1870.[1]

UBANGI. A northern riverine district of the Belgian Congo. Libenge and Banzyville are the chief towns.

UBANGI-SHARI. An inland colony of French Equatorial Africa (French Congo), bounded on the south by the Ubangi River. The capital is Bangui. Area, 236,363 sq. miles; pop. (1931), 1,090,084. Formerly the region was known as Ubangi-Shari-Chad, but since 17th March, 1920, Chad has been a separate territory; area, 398,955 sq. miles; pop. (1931), 1,053,006.

[1] Schweinfurth, Georg August, African explorer, born 1836 in Riga, studied at Heidelberg, Munich, and Berlin, and began this explorations by a series of journeys in the country between the Red Sea and the Nile (1863-6). On behalf of the Humboldt Institution of Berlin he undertook a journey in the heart of Africa, travelling up the Nile, investigating the hydrography of the Bahr-el-Ghazal and plunging in the company of ivory traders into the heart of tropical Africa. He explored the country of the Dinkas, Bongo, and Niam-Niam, and discovered the pygmy Akkas (q.v.), returning to Khartum in 1871. His works include *Im Herzen von Afrika* (published in English as *The Heart of Africa*). Schweinfurth was associated with Gerhard Rohlfs in the latter's expedition into the Libyan Desert (1873-4).

UBATÉ. A town of Colombia, South America, in the department of Cudinamarca, on the Sabiá; served by the northern railway from Begotá. Pop. 8000 to 10,000.

UBEDA. A city of Spain, in the province of Jaen; served by rail (14 miles) to Baeza (Empalme). It is the centre of the oil and viticultural region of the Loma de Ubeda plateau, and has also a royal stud of horses. Pop. 22,360.

ÜBERKINGEN. A village of Württemberg, on the Fils; served by the Geislingen-Wiesenstige line of the State Railways, and noted for its chalybeate bath. Pop. 800.

ÜBERLINGEN. A town of Baden, on the Uberlingersee, the north-west arm of the Bodensee (Lake of Constance, q.v.). It is served by steamer from Ludwigshafen to Meersburg and Constance, and is on the railway to Ludwigshafen and Friedrichshafen. There is a chalybeate spring (temperature, 57·2° F.), and a bathing establishment. Pop. 6000.

U-BOAT (Ger. *Unterseeboot*). A name applied to German submarines during the European War, and derived from the distinguishing class letter U usually found on the hull or conning-tower of such craft. Germany lost over 200 U-boats, but the actual number destroyed is problematical, although Mr. Lloyd George, speaking on 7th Aug., 1918, said that 150 had then been either captured or destroyed, and that more than half of that number had been immobilised during 1917. German protests on the exaggerated nature of this statement were met by the publication of 150 names of U-boat commanders who went down with their ships or were either captured or interned by neutrals.

To this grim testimonial the German Admiralty complained that the rank of several officers was not stated correctly! but belligerents and neutrals alike must immediately have seen that the total names available and printed could only represent a percentage of the U-boats destroyed, since the designation of many commanders would not, for obvious reasons, be available.

UCAYALI. *See* AMAZON; APURIAC.

UCKFIELD. Market town of Essex. Situated on the Sussex Ouse, is 8¼ miles from Lewes and 42¾ om London, on the Southern Railay. It is a farming centre, and has a agricultural college. Pop. (1931), 557.

UDAIPUR. A native state of Rajutana, India. It is physically a high lateau with a north-easterly versant, ut in the south-west it is traversed y one of the roughest sections of he Aravalli Hills. Agriculture is the hief industry, the chief autumn crops eing *til*, cotton, maize, and sugarane, and spring crops, wheat, barley, ram, and poppy. There is some orestry, and the state is rich in unxploited mineral resources (tin, rgentiferous lead, zinc, iron, garnets, tc.).

In the east the Rajputana-Malwa Railway runs north and south. Udaipur City is the capital. Area, 2,691 sq. miles; pop. 1,100,000 Bhils, Mahajans, Brahmans, Rajputs, etc.). The climate is healthy; mean nnual temperature, 77° F. (January, 1°; May, 89°); rainfall, 25 inches 14 inches in July and August).

UDAIPUR. A city of Rajputana, India, capital of the state of Udaipur; served by rail (67 miles) to Chitor. It was founded in 1559 by Rana Udai Singh, after whom it is called. There are some unimportant manufactures of embroidery, arms, and fancy cloth. Pop. 34,789 (mainly Hindus, with some Moslems and a few Jains).

UDALL, Nicholas. Writer of the first regular English comedy, born 1506, died 1556. He was headmaster of Eton from 1534 to 1541, and the play *Ralph Roister Doister* was written for the performance by the scholars. Its authorship was not ascertained till 1825. He was in favour at court as a writer of pageants and interludes.

UDDEVALLA. A port of Sweden, in the län of Göteborg and Bohus, at the head of the Byfjord; an important railway junction on the Göteborg-Strömstad line (via Munkedal) for Bengtsfors (via Bäckefors). There are a college, a school of navigation, and a polytechnic school; shipbuilding and other industries, and local fisheries. Exports include herrings, fish-guano, paper, and oats. Gustafsberg watering-place is nearby. Pop. 15,104.

UDINE. A department of Venetia, North Italy, forming part of Friuli (q.v.); area, 2749 sq. miles; pop. (1931), 718,245. It comprises (1) a northern zone, traversed by the Carnic Alps and part of the western versant of the Julian Alps; and (2) the Friulian division of the Venetian plain, traversed by the Tagliamento, Livenza, Stella, and Natisone (an affluent of the Isonzo). Among productions are silk, corn, maize, wheat, fruit, and potatoes. The red-coated Friulian cattle are noteworthy. Cheese is produced. Udine is the capital.

UDINE. The capital of Udine province, Venetia, North Italy; a railway junction 84½ miles from Venice, on the line Venice-Tarvisio, for Vienna, Trieste via Monfalcone (53 miles), and for the line Cividale-San Giorgio (29 miles). Industries include silk and cotton spinning and weaving, watch-making, wine-growing, and the manufacture of leather and wooden goods. The mean annual temperature is 55·5° F. (January, 37·6°; July, 75°). Pop. (1931), 66,488.

Udine is an archiepiscopal see, and has shared in the fortunes of Friuli generally. During the eleventh century it became the seat of the patriarchate of Aquileia, in which the Emperor Henry IV. had vested the ducal authority, and in 1420 passed under Venetian dominion. From 1797 to 1805, when it was added to Napoleon's Kingdom of Italy, Udine was under Austrian sway.

In 1808 Marshal Duroc (q.v.) was made Duc de Frioul (Friuli) by Napoleon, but the title and arms were assumed by the Emperor of Austria again in 1815, and from that time until 1866, when it became part of the Kingdom of Italy, Udine was an Austrian appanage.

UFA. A town and river-port of the Russian S.F.S.R., capital of the Bashkir A.S.S.R., on the Byelaya at the confluence of the Ufa; served by the main Siberian line which runs from Samara, via Ufa, over the Urals into Asia. There are considerable manufactures. Pop. 98,550.

UGANDA. A British protectorate of Central Africa. It is divided into administrative regions as follows: *Eastern Province*, containing the districts of Busoga, Teso, Lango, Karamojo, Bugwere, Bugishu, and Budama; *Western Province*, comprising Toro, Ankole, and Kigezi; *Northern Province*, divided into Bunyoro, Gulu, Chua, and West Nile; and *Buganda*, which embraces Mengo, Masaka, Mubendi, and Entebbe districts. Rudolf Province (which is not included in the above area) is now administered by Kenya. Entebbe (altitude, 3863 feet; pop. 10,000), a port on the northern shore of Lake Victoria, is the administrative capital of the protectorate.

Area and Population. The total area is about 94,204 sq. miles, 13,616 sq. miles representing water-surface. Pop. (1931), 3,553,534 (3,536,267 natives).

Communications. The Kenya and Uganda Railway, connecting Ripon Falls (Jinja), on the Victoria Nile, with Namasagali, and the Kampala Railway (7¾ miles), linking Port Bell with Kampala, are the chief railways. There is a bi-monthly steamer service on Lake Albert, and on Lake Victoria

Communications. The Kenya and Uganda Railway, connecting Ripon Falls (Jinja), on the Victoria Nile, with Namasagali, and the Kampala Railway (7¾ miles), linking Port Bell with Kampala, are the chief railways. There is a bi-monthly steamer service on Lake Albert, and on Lake Victoria a weekly steamship service connects Entebbe with Kisumu in Kenya Colony, the terminus of the Uganda Railway to the coast (Mombasa).

On Lake Kioga, Namasagali and Port Masindi have steamer connections, interrupted sometimes by masses of *sudd*.

Production. Uganda is mainly agricultural, and the chief products are native cereals. In some places, however, cattle form the main source of wealth, and cotton may be accounted the principal economic product. Bananas are important and, with millet and pulse, form the native staples. Coffee is an indigenous plant in Buganda, where it is allowed to grow wild; but Europeans cultivate the *Coffea arabica*, which was introduced from Nyasaland, and is now their chief plantation crop.

Tapioca, the castor-oil plant, chillies, dhal (the Congo pea, grown especially in Kigezi district as a food crop), ground-nuts (in Kioga district), maize, rice, rubber (the third crop in economic importance), sesame (Eastern Province), some sugar-cane, large quantities of tobacco, and many other crops are also grown in Uganda. The forestal resources are important and include species of the African mahogany class, which are valuable for export purposes.

Government. The protectorate is governed by H.M. the King in Council, authority being relegated to the Secretary of State for the Colonies, to whom the Governor, who has supreme civil and military power, passes copies of his ordinances for approval. There is a complicated system of local government operating on a provincial basis; but this does not apply in the Rudolf Province (q.v.), where a political officer enforces the laws as far as possible.

Otherwise, the provinces are controlled by Provincial Commissioners, representing the Governor and exer-

cising judicial authority, while controlling a staff of District Commissioners, who, among other duties, supervise the assessment, etc., of taxes. Buganda (area, 22,734 sq. miles) is a kingdom, of which the *kabaka*, or king (styled " His Highness "), is a vassal of H.M. the King-Emperor. Local autonomy is more or less completely exercised within his domains. *See* TORO ; UNYORO ; etc.

History. The British protectorate was proclaimed on 19th June, 1894, and the country was immediately garrisoned by the remnant of the army of Emin Pasha, to which was added some irregular Baganda and recruits from the White Nile. This force was successful in dealing with the risings of the Kings of Unyoro and Buganda, but was later superseded by an Indian detachment. In 1897 Mwanga of Buganda and Kabarega of Unyoro again rose, but the rebellion was suppressed, and the two kings were eventually sent into retirement in the Seychelles. Since 1900 considerable political and economic progress has been made.

BIBLIOGRAPHY : *Handbook of Uganda Protectorate* (compiled for the Admiralty : H.M. Stationery Office), a general handbook ; W. G. Kendrew, *The Climates of the Continents* (includes a chapter on the climate of the region) ; *Kenya, Uganda, and Zanzibar*, No. 96 of vol. xvi., *Peace Handbooks* (H.M. Stationery Office), a general geographical and historical handbook.

UGRIAN. A division of the Turanian group of peoples, the chief subdivision of which is the Magyars or Hungarians, who number upwards of 10,000,000 souls. The other two tribes are the Ostyaks, mainly Shamanistic beliefs, and the Voguls, who are nominally Christians and are found partly in Northern Europe. The original home of the Ugrians was the eastern or Asiatic versant of the Urals, or the region of the River Ob, whence, within historic time, the Ungars detached themselves from the main group and settled in the basin of the Danube, losing, in course of time, their Turanian characteristics through their free intermingling with Slav and other peoples of non-Turanian blood. There are about 18,000 Ostyaks and 7000 Voguls, both tribes being chiefly hunters and fishermen, and located south of the Samoyeds, in a wide region both east and west of the River Ob.

UGRO-FINNS. A branch of the Turanian family of peoples, whose language is known as the Ugro-Finnic (or Finno-Ugric) division of the Ural-Altaic (i.e. Turanian) family (*see* URAL-ALTAIC). The Ugro-Finns, about 16,000,000 in number, are divided into Finnish and Ugrian sections, the former comprising some 6,000,000, and the Ugrian about 10,025,000. Of the three main divisions of the Ugrians (q.v.) the Magyars are of most importance, and the group is more or less Christian and European.

The Finnic group (*see* FINNS) has two main sections, Russian and Scandinavian (60,000 distributed over Norway and Sweden). Both the Magyars and the Finns have been greatly influenced by European culture, and have succeeded in preserving the characteristics of their nationality where their less cultured relatives have been more or less slavonised, and will in due course disappear by absorption into the Slav race.

Apart from the Magyars and Finns, Christianity has been adopted by most of the Ugro-Finnic groups. Their Christianity, however, is in many cases merely a veneer superimposed upon Shamanism, ancestor worship, and witchcraft.

UINTA MOUNTAINS. A range of Utah, United States, east from the Wahsatch range. *See* ROCKY MOUNTAINS.

UIST (wist), **NORTH.** An island of the Outer Hebrides, 17 miles long and from 3 to 13 miles broad, separated from Harris by the Sound of Harris. The surface is chiefly flat, the coast greatly broken by inlets from the sea, and the principal industry is fishing. Pop. (1931), 2832.

UIST, SOUTH. Separated from North Uist by the Island of Benbecula, it is 22 miles in length and 7 miles in breadth. The surface is lowlying in the north, but the remainder is mountainous. Lochboisdale is the chief place. Pop. (1931), 4236.

UITENHAGE. A town of Cape Province, Union of South Africa, chief town of the district of Uitenhage (2973 sq. miles), a noted centre in the wool-washing region of the Zwartkops River valley. There are large railway repair-shops. Uitenhage is about 20 miles by rail from Port Elizabeth. Pop. (1921), 14,100 (7810 white) ; white pop. (1931), 9347.

UJIJI. A district and town of Tanganyika Territory, Africa. The district has a coast-line of over 75 miles on the east shore of Lake Tanganyika, to which it is drained by the Mlagarasi River ; and it is traversed from east to west by the Central Railway from Dar-es-Salaam. Yams, sugar-cane, sweet potatoes,

ground-nuts, and the oil-palm are the staples.

Ujiji town is the chief place, and is associated with such names as Burton and Speke (1858), Sigl (who hoisted the German flag there in 1893), and David Livingstone (who arrived in 1869, and was found at Ujiji by H. M. Stanley on 28th Oct., 1871).

The town stands on Lake Tanganyika, about an hour's journey from Kigoma, its port and the terminus of the Central Railway, and it is considered one of the main trading centres of the Territory. Pop. (town), 25,000.

UKRAINE (Russ. *Ukraina*, borderland). A Socialist Soviet Republic embracing several of the former governments of South Russia. It joined the Soviet Union in 1920, and includes the autonomous Moldavian Republic. Area, 166,368 sq. miles or 2·2 per cent of the whole Soviet Union. Pop. (1931), 31,403,200.

Physical. Ukraine comprises (1) a central region of undulating steppeland belonging to the drainage basin of the Dnieper and extending, with a slight versant from north to south, over the former governments of Chernigov and Poltava. On the west lies (2) the Black Sea or Avratynsk Plateau, drained by the Bug and Dniester, and extending over Southern Volhynia and all Podolia, with an easterly extension to the Dnieper Valley as the plateau of Kiev. In the east are (3) the table-land of Kharkov and (4) the Donetz Hills, both drained by the Don and the Dnieper. There is a limited but very important seaboard on the Black Sea and Sea of Azov.

The north-western region of Ukraine occupies part of Polyessyĕ and belongs to the basin of the Pripet. The name (Polyessyĕ) means "the woods," and is used to designate the more or less afforested region, triangular in shape, enclosed by the Berezina and Pripet, tributaries of the Dnieper, and the flat region of Volhynia north of the Avratynsk Plateau. This is an area of swamps and marshes (e.g. Pinsk marshes, 600 sq. miles) from which some 5,000,000 acres of arable and pastoral land have been reclaimed by a canal system initiated by the German colonists. The Polynesian flora is found also in the afforested lowlands of Northern Kiev, and there are riverine zones in Podolia, and in Chernigov north of the Desna (an affluent of the Dnieper). The industries of Polyessyĕ and those of the marshy region in Chernigov are chiefly related to the lumber industry, and include the leaching of wood for potash, boat-building, and the manufacture of wooden dishes; but apiculture, hunting, fishing, and general agriculture are progressive.

Production and Industry. The Black Earth crosses Ukraine from east to west, covering all the former government of Podolia, South and Central Kiev, and part of Yekaterinoslav. This zone is therefore one of the richest agricultural areas in the world, and its astonishing fertility is reflected in the quantity and immense variety of its products. Market-gardening, fruit-farming, viticulture, and the raising of cereals are of great importance, as is also stock-breeding, one of the chief nurseries of the pre-European War cavalry horses of the Russian army being centred in Podolia, where stock-raising is the chief business. Large horse-fairs are held at Kharkov. Apiculture is almost universal, and there is a great sugar industry, of which Kiev is the metropolis.

Probably nowhere in the world, except only Scotland, are distilleries so common, and distilling and sugar manufacturing may be said to dwarf by comparison all the other Ukrainian industries put together. If there is any exception to this general statement, the mineral wealth of Ukraine provides it, and the Donetz coal-basin is possibly the greatest single mineral asset in the sadly mangled remains of the Russian Empire.

There is considerable hydroelectric development on the rivers; the hydroelectric station at Dnieprostroy was opened in 1932. Owing to its agricultural, mineral, and manufacturing wealth, the Euxine, Don, and Dnieper fisheries, and the possession of a large and brisk foreign trade through the ports of Odessa, Ochakov, Mariupol, and Nikolaiev, Ukraine is obviously an exceedingly valuable partner in the Union of Socialist Soviet Republics. See articles on former Imperial governments. See also RUSSIA.

Donetz Coal-basin. The Don Hills or Donetz hill range lies west of the Donetz River, trending in a south-easterly direction from near Zmiev in Kharkov to the confluence of the Donetz with the Don, a distance of roughly 250 miles. It has eastern and western branches, and comprises the western part of the Don Cossack Territory, north-eastern Yekaterinoslav, and part of Kharkov, with an area of about 17,740 sq. miles. (All references are to pre-Revolutionary governments.) The western branch extends to the Dnieper Valley, and attains an altitude of 850 feet; the eastern branch runs to near Lugansk, and attains an altitude of 1145 feet at Ivanovka. Partly in these hills

and astride the Donetz River lies the Donetz coal-basin, 10,425 sq. miles in area, enclosed by the Volchya (a tributary of the Dnieper) in the west and the Kagalnizk (a tributary of the Don) in the east. The eastern and central parts of the basin provide anthracite, and the west bituminous, coal, both of which have been regularly worked since 1839. Other minerals of the region are: chalk, lime, iron (from the Krivoy-Rog deposits), kaolin (from Poltava), argentiferous lead, rock- and brine-salt (chiefly from Slavyansk), manganese (from Nikopol, near Krivoy-Rog), and cinnabar, the chief ore of mercury. *See* DONETZ; DON; YEKATERINOSLAV.

Literature. Long before the Ukraine, or Little Russia, was annexed by the rulers of Moscow, it possessed a literature of its own. Kiev was the intellectual centre, and it was there that the old Russian chronicles were compiled. Famous are the *Chronicle of Nestor*, the *Testament of Ostromir*, and the *Song of Igor*, which may be compared to the *Chanson de Roland*. The origin of the heroic songs of the Ukraine, known as *Doumy* (to be distinguished from *Bylini*, q.v.), is traced back to the ninth and tenth centuries.

During the Mongolian invasion Ukrainian culture and literature exercised a considerable influence in Lithuania. Abandoned by the nobles during the seventeenth century, Ukrainian literature was cultivated by the clergy, and especially among the Cossacks. The epic poetry of the period, one of the richest and most beautiful of popular Slavonic poetry, deals with the exploits of the Cossacks and of their famous hetmans, Samuilo Kyshka, Semen Palyi, and others.

Under Catherine II. the Ukraine became russified, and the literary works of the country were written mostly in Russian or in Polish. The national spirit of the Ukraine was, however, still alive. The philosopher Gregory Skovoroda (1772-94), Gogol, and Korolenko were Ukrainians, but they wrote in Russian, just as the Swiss Rousseau and the Belgian Maeterlinck wrote in French.

The renaissance of the real Ukrainian literature was inaugurated towards the end of the eighteenth century by Ivan Kotlyarevsky (1769-1838). He did for the Ukrainian language what Lomonossov and Pushkin had done for the Russian, and raised the popular Ukrainian idiom to a literary language. Among other works Kotlyarevsky wrote two comedies, *Natalka Poltavka* and *The Soldier Sorcerer*.

Kotlyarevsky's example was soon followed by numerous other writers. The great poetical genius of the Ukraine was Taras Ghevtshenko (1818-61). His collection of poems, *Kobzar*, appeared in 1840, and *The Haidamaks* in 1841. He was an apostle of liberty, the Ukrainian prophet and poet. More recent writers are: Maria Markovitsh (Marko Vovtshok), whose tales have been translated into Russian by Tourgueniev; Ivan Franko; Lesia Oukraïnka (Larissa Koitka); Khrystia Altshevska; the historian Myrkhailo Hroutshevsky; and Vladimir Vinnitshenko.

ULCER. A suppurating area on a free or open surface; an open sore. There are various forms of ulcer: *follicular*, a small ulcer on a mucous membrane; *gastric or peptic ulcer*; *rodent ulcer*, which involves all tissues and is malignant in type (*see* CANCER); *serpiginous*, an ulcer which, while healing at one part, is progressing at another part; *perforating ulcer*, one that eats through the wall of the affected organ; *tuberculous ulcer*, due to tuberculosis; and *varicose ulcer*, due to varicose veins (q.v.).

ULEÅBORG (ūleobor'), or **OULU.** The largest and most northerly department of Finland. It comprises in the east and north the plateaux of Laponia (16,000 sq. miles; 1100 feet altitude), which are largely barren, and are inhabited by some 600 nomadic Lapps, who own upwards of 100,000 reindeer; and in the west, the northern zone of the Osterbatten, or rich plains of the Gulf of Bothnia. North of Uleaborg town the coast is fringed with sand-dunes. None of the rivers (Tornio, Ulea, etc.) are navigable, and are therefore used for floating timber.

Lakes include Ulea, Enare (in the far north), Kianta, and Piha. Uleaborg (officially *Uleaborg and Petsamo*) is served by the Tornio-Leningrad trunk line (*see* TORNIO), which sends a branch along the Kemi River from Kemi to Rovaniemi, an important timber centre.

The chief towns are Uleaborg (capital), Tornio, Brahestad (Fin. *Raahe*; a seaport on a branch of the main trunk railway; exports pitch tar, timber, etc.; pop. 5000), and Kajana (Fin. *Kajaani*), the terminus of a branch line from Kuovola, running via St. Michel (Fin. *Mikkeli*) and Kuopio. There are great forests, and extensive fisheries in the Gulf of Bothnia and the lakes. Area of department, 65,244 sq. miles; pop. (1930), 425,278.

ULEÅBORG, or **OULU.** A seaport town of Finland, on the Ulea River and the Gulf of Bothnia; served by

rail from Tornio. It is an industrial place whose prosperity is founded on leather, and it is the tanning and boot- and shoe-making metropolis of Finland, possessing also the oldest and largest sole-leather factory (that of Bröder Aström Aktiebolag) in Northern Europe. Imports include coal, iron, and foreign produce; and among exports are butter (some of which goes to Denmark, where it is re-exported as Danish butter), tar, pitch, fish, and lumber (including sawn wood, the Ulea River being largely used for timber-floating). Uleaborg was founded in 1605, and during the Crimean War, Plumridge, with a British fleet, burned the dockyard, etc. (1st June, 1854). Pop. (1930), 24,186.

UL'FILAS, ULPHILAS, or **WULFILAS.** Bishop of the Goths of Mœsia, born in A.D. 311, died at Constantinople in 381. He translated most of the Bible into Gothic (Mœso-Gothic), employing the Greek of the *Septuagint* for the Old Testament, and a Greek text, different from the received text, for the New. Only some fragments of this translation have been preserved, including the greater part of the four gospels, and these are of the highest linguistic value. *See* GOTHS. — Cf. C. A. A. Scott, *Ulfilas: Apostle of the Goths.*

ULLSWATER. A lake in England, between the counties of Cumberland and Westmorland, about 7½ miles long, and varying in breadth from ¼ mile to ¾ of a mile; depth, 210 feet.

ULLSWATER, Viscount. English statesman. James William Lowther was born 1st April, 1855, and educated at Eton, King's College, London, and Trinity College, Cambridge. He was called to the Bar in 1879, entered Parliament as member for Tutland in 1883, represented Penrith 1886-1921, and was Speaker of the House of Commons from 1905 to 1921, being created viscount on his retirement. Since then he has served as chairman of many royal commissions, such as those on London government, political honours, and electoral reform. He is a trustee of the British Museum.

ULM (ulm). A town of Württemberg, on the Danube. Its manufactures include machinery, woollen and linen cloth, leather, paper, and brassware. A free Imperial city in the fourteenth and fifteenth centuries, Ulm was annexed to Bavaria in 1803, but became part of Württemberg in 1810. The capitulation of Ulm in 1805 was the turning-point of the campaign of Austerlitz.

From 1842 to 1866 it was a fortress of the Germanic Confederation. Ulm is an important junction on the Stuttgart-Munich Railway, via Geislingen, for Aalen, Memmingen, Sigmaringen, and Friedrichshafen. Pop. 59,357.—**Neu-Ulm,** a modern town of Bavaria, stands on the Danube, opposite Ulm. Pop. 11,000.

ULMA'CEÆ. A natural order of dicotyledons, of which the genus Ulmus or elm is the type. It is nearly related to Urticaceæ (the nettles), from which it differs only in having a two-celled fruit and hermaphrodite flowers. It consists of trees or shrubs, which have scabrous, alternate, simple, deciduous leaves and fugacious stipules.

ULPIAN (Ulpianus). Roman jurist, a citizen of Tyre, born about A.D. 170, assassinated 228. Justinian, in his *Digest,* made large use of Ulpian's legal works, quoting over 2700 extracts.

ULSTER. History. The modern name Ulster, like Leinster and Munster, is a hybrid, and comes from the Icelandic *Staor*—a steading, added to the name *Ulaidh.* It is really the name of the ancient population, or tribe, which inhabited the land. In earliest times Ireland was divided into five principal provinces or kingdoms —Ulster, Munster, Leinster, Connaught, and Meath—which were each in turn divided into lesser divisions or chiefdoms. It would appear, however, that Ulster was always the strongest and most independent, also the most turbulent, of the greater provinces, and its dominant princes or chieftains, the O'Neils and the O'Donnels, disputed with one another and with the other Irish princes for the overlordship of the whole island.

It was the misfortune of Ireland, which was never a nation in the true sense of the word, that her chieftains were never united for the well-being and protection of the country. For almost two hundred years previous to the first landing of the English in Ireland the country was desolated, devastated, and depopulated by constantly recurring petty internecine wars, in which chieftain strove with chieftain for the supremacy.

Each king or prince desired to become the *Ard-Ri* (chief sovereign), and no sooner had one achieved this position than he was thrown from power and another seized the mastery. To such a state of degradation and misery, morally and materially, did the Irish sink that their condition became a scandal to Christendom, and Pope Adrian IV. was compelled to intervene and order Henry II. to "enter Ireland, and reform its faith, morals, and government."

With the coming of the English,

Ulster was granted as a palatinate to a Norman knight named de Courcy, the Ulster chieftains still holding their rights and many of their former privileges. Henry VIII. and Queen Elizabeth were, however, the first English sovereigns whose rule was really respected, if not obeyed, in Ulster. Proud and fiercely independent, the Ulster chieftains, O'Neil and O'Donnel, strove desperately to rid the country of the English. Forced to submit, they eventually rendered homage to Queen Elizabeth and accepted the titles of "Earl of Tyrone" and "Earl of Tyrconnell" in lieu of their royal titles "The O'Neil" and "The O'Donnel."

But their submission was short-lived, and they were again found guilty of plotting against England with France and Spain. Fearing the consequence of their treachery, they fled to Europe with their families and a few of their retainers, and their chieftainships were never restored. Their flight, commonly known as "The Flight of the Earls," marked a new era in Irish history, for it was then that the "Great Plantation" of Ulster was made by the ancestors of the race now known as the "Ulster Scots."

The accession of James I. and VI. to the English throne brought about the union of the English and Scottish crowns (1603). The condition of Ireland gave the new sovereign and his advisers cause for grave anxiety, and a scheme, which King James claimed to have personally organised, was set on foot to colonise the lands forfeited and deserted by the Ulster chieftains with families of Lowland Scottish and North English birth—"being Protestants."

These Ulster estates covered six counties—Tyrone, Coleraine (afterwards entitled Londonderry), Donegal, Fermanagh, Cavan, and Armagh—and measured about a million acres, of which one-third was bog-land, mountainous, and wooded territory. The colonists were carefully selected, and were, for the most part, taken from the ranks of the nobility and gentry and retired soldiers who had proved their loyalty to Queen Elizabeth and her successor.

The colonists were given the names of "Servitors," "Undertakers," or "Planters," and they obtained free lands, by royal grant, from the English king and his Government under certain conditions. They were to render numerous services to the Crown in return for their lands, and, from within two years from the date on which they entered into possession, they were to have commenced to erect "defensive buildings for the protection of the colony" as a whole.

The greater colonists were permitted and, indeed, were obliged to bring with them "suitable families wherewith to people their estates and assist in the work of colonisation and the promotion of industry."

Ulster had been left desolate and ruined after centuries of strife. The land was untilled and unfruitful; the natives were dying of famine and disease. If this misery was to be rectified, the marsh-lands had perforce to be drained, the forests cut down, and life made secure. One of the stipulations which King James made to the "Planters" was that they "should speedily build towns and villages, erect churches and schools, and establish thrifty industrious habits amongst the natives." Nor was that all that was expected of the "Undertakers."

For a century or more Ireland had been a constant danger to the English Government. Imbued with jealousy, more than actual hatred, towards their English rulers, the Irish chieftains had constantly intrigued with the Catholic Powers, Spain and France, to bring about the downfall of Protestant England. It was urgent, therefore, that a standing army should be maintained in Ireland which could be relied upon to render immediate service to the Crown when occasion required.

It was consequently arranged that the "Undertakers" should supply the force needed "with men, arms, and ammunition." Every colonist was under obligation either to furnish a troop or to serve in one, according to the size of his land grant. The wealthier colonists were expected to give from their estates so many men-at-arms and to lead them in person; while the lesser "Planters" and tenants supplied a few soldiers or rendered personal military service.

It is estimated that in the first year or two after the "Plantation" was founded the six counties thus colonised mustered over 7336 well-armed men, which in a settled country would imply a population of about 29,000; but it would be safer to reckon upon not more than 20,000 colonists as existing during the first generation after the arrival of the earliest "Planters."

The colonists of Ulster founded the first of the colonies or Oversea Dominion States, which, taken collectively, are now known as the "British Empire." Until the formation of the Ulster colony, England had made no permanent overseas settlement, simply because, as in the case of all previous attempts to colonise Ireland, the colonists had not taken their women-

folk into exile, and the early English settlers in Ireland, as elsewhere, had intermarried with the natives and become "more Irish than the Irish." The Ulster "Planters," however, took their wives and children into "this veritable wilderness," as a contemporary writer described it.

The colonists were naturally a strong, stern folk. Two-thirds of them were adherents of the Calvinistic faith, and belonged to the Scottish Presbyterian Church, and it may be said that the Ulster colonists have lived from that time (1607) to the present day a people standing apart

In return for the tilling of land, and all the military and civil services which the holding of these lands entailed, King James and his Government assured the colonists on oath that "They and their descendants would for ever retain their rights and privileges as freeborn English citizens," and "in case of attack by the King's and their enemies, they could rely upon His Majesty's assistance and sympathy."

and alone. Within a few years of their coming the six north-eastern Irish counties were transformed. Every tillable piece of ground began to yield increase, new towns had sprung up, schools were founded, and law and order were established.

The Civil War in England, however, extended to Ireland, where the Irish took up arms in favour of the Stewart king, and seized the opportunity to rush upon the Protestant Ulster

colonists, whom they overpowered and all but exterminated.

This terrible massacre of the "Planters" was cruelly avenged by Cromwell (1649-52), who banished the Catholic Irish from Ulster. Under Charles II. many of the laws which bore heavily upon the Irish Catholics were relaxed, while the Ulster colonists, as Nonconformists, were subjected to persecution at the hands of the king's Deputies and Ministers. The injustice of the treatment shared by the Ulster colonists with their Scottish kindred across the channel was increased by the fact that they had favoured the restoration of Charles II.

Ireland was comparatively quiet when James II. succeeded to the throne (1685). Once more, with the outbreak of civil war in England, Ireland burst into flames. In April, 1689, Londonderry, the capital at that time of the Ulster colony, was attacked by the French and Irish armies under the personal command of James II.

After a siege of 105 days the city was relieved by some English ships, which broke through the boom laid by the army of James across the River Foyle and supplied the garrison with food and ammunition. James II. met with final defeat on the banks of the River Boyne, where, on the 1st of July, 1690, King William and his Dutch and English army, supported by the Ulster colonists and a number of French Huguenots, gained the victory over the last of the Stewart sovereigns.

The history of all Ireland, including Plantation Ulster, presented, from the year 1698 to the year 1798, a doleful picture of mismanagement and incompetence. The Ulster colonists suffered continual persecution and injustice as Nonconformists, as the Irish also suffered for adhering to the Catholic Church. The industries of both Plantation Ulster and Catholic Ireland were destroyed by order of the English Government, which detested alike Catholics and Nonconformists.

Goaded and infuriated, many of the colonists sailed for America, where, on the outbreak of the War of Independence, many of them joined Washington's army. Two-thirds of the names appended to America's Declaration of Independence are those of Ulster Scots.

In 1798 a rebellion broke out all over Ireland, in which, for the first and only time in history, the persecuted Irish Catholics and the Ulster Presbyterian colonists united to secure the religious freedom denied to both sects by the British Government. The rebellion proved unsuccessful in the opinion of the Irish Catholics, who desired utterly to destroy English rule in the whole island.

The Ulster colonists, however, when they were permitted to worship God after their own fashion, once again became the most loyal of British subjects. The Act of Union was passed in 1801, under the parliamentary leadership of William Pitt, and largely owing to the genius of an Ulster Scot—Lord Castlereagh—the ancestor of the present Marquess of Londonderry, and from that date until 1921 Ireland ceased to have a Parliament of its own.

The unfair land laws which held good in the greater part of Ireland did not trouble Plantation Ulster, where tenants had always possessed interest in their land holdings and could sell or leave at will. Consequently Ulster did not experience the same dire need for the Land Law Reforms which were introduced by Gladstone in 1870 and 1881. In 1886 Gladstone brought forward a Home Rule Bill for Ireland, which was heavily defeated in the House of Commons (*see* HOME RULE).

Ulster was bitterly opposed to any measure that would give Ireland, as a whole, self-government. This opposition was based on the fact that the Ulster Scots were different by race and religion to the Irish, and as the Irish resented being ruled by a British Parliament, so they—the "Planters"—objected to be governed by an Irish Parliament, the majority in which would be, both by blood and religion, as "foreign" to them as the English were "foreign" to the Irish.

Another Home Rule Bill was defeated in the House of Lords in 1893. In 1912 Mr. Asquith introduced yet another Home Rule Bill, which, owing to the operation of the Parliament Act, the House of Lords was powerless to stop. Ulster refused to enter an Irish Parliament, and the Ulstermen prepared to resist the attempt to force them against their wish out of the Imperial Parliament. They pointed to the Oath taken by James I., whereby their rights and liberties as English citizens were to be for ever respected.

In 1911 Sir Edward Carson—afterwards Lord Carson—was unanimously elected leader of Ulster, and in Sept., 1912, under his guidance, the men and women of Ulster bound themselves together under "the Oath of the Covenant" to use all means which might be found necessary to defeat the conspiracy to set up a Home Rule Parliament in Ireland. Within a year the province was in possession of a Volunteer force of 100,000 men.

This force was lacking in arms and

ammunition when, in March, 1914, Mr. Asquith's Government issued an order to some British cruisers to proceed to Belfast—the modern capital of Ulster—and to some troops (infantry, cavalry, and horse-artillery) to make certain movements in Ulster. The only effect of these orders was that certain army officers garrisoned in Ireland resigned. Thoroughly alarmed, however, the Ulstermen realised their need for modern weapons; and, in April, 1914, they contrived to purchase, bring into harbour, unload, and, in a few hours, distribute over the six "Plantation" counties a large number of rifles, with ammunition. On the 4th of Aug., 1914, the European War broke out.

In the House of Commons, John Redmond, the Irish leader, offered the services of his followers to the Empire for the "defence of the shores of Ireland." Sir Edward Carson, speaking on behalf of Ulster, offered the Ulster Volunteers for "Imperial foreign service in the field," only stipulating that they should be recognised as "a separate and distinct division" and that "no attempt would be made during their absence to bring the Home Rule Bill into law."

The Government agreed to these simple terms, and Sir Edward Carson, in person, led his followers to the recruiting station, where "the Covenanters" formed themselves into the historic 36th (Ulster) Division.

From that time on Ulster steadfastly upheld the Empire's cause in the war. In the great shipyards of Belfast work was carried out, day and night, without a strike, for four and a half years, and the Ulster linen factories and mills, also working day and night and without strikes, achieved the gigantic task of supplying the linen needed for the Air Forces of the Allied armies of Britain, France, Italy, Belgium, Serbia, and America.

The enemy had seized all the flax-growing and flax-spinning districts of the Continent. Ulster alone could supply the material, the factories, and the trained industry for the manufacture of "the wings" for the Allied aeroplanes. Meanwhile Mr. Asquith and his party disregarded their promise to Ulster, and no sooner had the Ulster "Covenanters" been enrolled in the Imperial army than he and the Liberal Government placed the Home Rule Act on the Statute Book, excusing this breach of faith by the promise that it should not be brought into force until a certain period after the declaration of peace.[1]

[1] For a brief account of the rise of Sinn Fein and of the 1916 rebellion, see *Ireland*.

In the General Election of 191 after the cessation of war, practical all Ireland, outside the frontiers the six north-eastern "Plantation counties, returned Sinn Fein, ani British candidates, whilst the s Ulster counties voted, almost to man, for the support of the Empi and the Coalition Government.

The newly elected Sinn Fein r presentatives refused to take the seats in the Imperial Parliament, ar the Sinn Fein Volunteer arm assisted by the rebellious populatic of the south, east, and west of Irelan opened a species of guerrilla warfa against the Crown forces, and again Plantation Ulster and all loyal perso of English and Irish birth who wei resident in the disaffected parts (the island.

The rebels were careful never t meet the Imperial forces in fair an open fight, but contented themselve with carrying on the most cruel an cowardly campaign against unarme and insufficiently armed people, whor they murdered in cold blood, and i open daylight, regardless of sex o age. The houses, factories, farms, an shops of the loyalists dwelling outsid the frontier of the Ulster countie were burned, robbed, wrecked, an confiscated.

A reign of terror and misery ensued and the King's Writ ceased to operat in all parts of Ireland beyond th boundaries of the "Plantation." The Imperial forces, soldiers, and police were outnumbered and killed; their hands were tied by the weakness o the Government, which was averse to the adoption of strong measures for the suppression of the rebels.

In 1919 the Sinn Fein leader, Mr. de Valera, procalimed "an Irish Republic," independent of Great Britain, and summoned a rebel Parliament in Dublin, called the *Dail Eireann*. Financed by large money loans, and reinforced by men and arms from America, the insurgents continued their campaign of assassination and destruction.

Ulster steadfastly supported the Empire, and as steadfastly adhered to the determination never to accept an Irish Parliament for the six north-eastern "Plantation" counties, where the Crown and Empire were obeyed and loved.

Meanwhile "The Ulster Council," an elected political body which had been formed in 1910-11 to guard Ulster's interests, still wielded control in the Imperial province. Eventually Mr. Lloyd George, the Premier, and the Coalition Government at Westminster were obliged to acknowledge that Ulster could not be coerced or persuaded into submission to an Irish

liament. The Home Rule Bill still in 1920 awaiting the date which it was to come into force, it was altered in so far that the north-eastern Ulster counties of ntation Ulster were excluded from Irish State and given a separate liament—to be known as "The liament of Northern Ireland." Ulster, though strongly averse even partial separation from the Imial Parliament, accepted the Act, ich safeguarded and guaranteed rights of Ulstermen within the pire, gave them representation in Imperial Parliament, and reved, once and for all, the danger domination by an Irish Governnt.

Elections were held in the six Ulster unties, and Sir James Craig became first Ulster Premier, with the n. Hugh O'Neill as Speaker. On e 22nd of June, 1921, King George made his State entry into Belfast d opened the first Ulster Parliament person. Plantation Ulster was nceforth responsible for its own fairs.

Sir James Craig and his Governent had undertaken an almost imssible task. The Sinn Fein rebel rces immediately concentrated upon ie Ulster borders, and imported gunmen"—many of these being ired Mexican and American adven rers—into Belfast, Londonderry, nd other Ulster towns.

These "gunmen" shot down peacel citizens in the trains, trams, and treets, in open daylight, in crowded treets, in factories, and even in hurches. Men, women, and children vere alike victimised. They also set ire to the shops, factories, and shipards in the industrial centres, whilst n the country districts organised ttacks were made on farms and roperty all over the province: iorses and cattle were mutilated, rops ruined, and banks were robbed, hiefly along the frontiers of the six ounties.

The Ulster Government, not having had time to get its police force into order, was, for a time, unable to cope with these raids, but eventually almost the entire male inhabitants of Ulster enlisted in a civil police force for the defence of their homes, property, and province, and in a comparatively short period the rebels retired across the Ulster borders.

The settlement of the Southern Irish problem in 1922, however, brought more peaceful times (*see* IRELAND; IRISH FREE STATE). Ulster, though possessed of its own Parliament, clings as closely as ever to Great Britain and the Empire, and jealously preserves the British rights and liberties of its people, its territory, and immense industries. *See* NORTHERN IRELAND. — BIBLIOGRAPHY: Ramsay Colles, *The History of Ulster*; S. J. Brown, *A Guide to Books on Ireland*.

ULSTER KING OF ARMS. The chief heraldic official in Ireland. He is registrar of the Order of Saint Patrick. The office owes its origin to Edward VI., who in 1551 substituted it for the earlier office of Ireland King of Arms, which dated from the time of Richard II. There are two heralds, Dublin and Cork, and a pursuivant, Athlone.

ULTIMUS HÆRES (Lat., last heir). A phrase used in Scots law. When a person dies without heirs, the property of the deceased, both heritable and moveable, after inquiry and the lapse of a certain space of time, falls to the Crown as *Ultimus Hæres*, but under burden of the debts of the deceased.

ULTRAMARINE. A blue pigment which was at one time obtained by grinding lapis lazuli. The costliness of this method led to attempts to produce the pigment artificially, and it is now produced commercially.

ULTRAMICROSCOPE. An apparatus for causing extremely minute particles of matter to become visible. From one side a very bright light is concentrated on the material; the particles scatter the light and become luminous, and when a powerful microscope is focused on them, they are seen by means of the diffraction effects which they cause. Their outline, however, is not perceptible.

ULTRAMONTANE. A term applied to regions situated beyond or on the far side of a range of mountains. It is frequently confined to the Alps. The word is also used to designate that body in the Roman Catholic Church which lays particular stress on the complete supremacy of the Pope in all matters of faith and discipline. The Ultramontanes have considerably influenced political affairs in France and Germany. See next article.

ULTRAMON'TANISM. The views of that party in the Church of Rome which places an absolute authority in matters of faith and discipline in the hands of the Pope, in opposition to the views of the party who would place the national Churches, such as the Gallican, in partial independence of the Roman curia, and make the Pope subordinate to the statutes of an œcumenical council. The Vatican Council of 1870 virtually established the views of ultramontanism as dogmas of the Church.

ULTRA-VIOLET RAYS. Rays of the nature of light which are invisible to the eye; in a spectrum, they are situated beyond the violet, and have shorter wave-length than the visible rays. At the extreme violet end of the visible spectrum, the rays have a wave-length of about 4000 Ångström units; the ultra-violet spectrum has been traced to beyond 1000 Ångström units. The rays are contained in sunlight, but the shorter waves are absorbed by the atmosphere.

The electric spark or arc is very rich in ultra-violet, especially when passed between electrodes of zinc or aluminium. When these rays fall on a mixture of hydrogen and chlorine gases, they cause the mixture to combine with explosive rapidity; when received on a photographic plate, they affect the plate in the same way as light but in a greater degree; hence the rays are sometimes called chemical or actinic rays. The rays undergo reflection, refraction, interference, absorption, and polarisation, and are subject to the ordinary laws of light.

When the ultra-violet spectrum of a given source is to be examined, it is necessary to use a prism and lenses of quartz or fluorite, since glass (with the exception of "uviol" glass) is highly absorbent to the ultra-violet. Schumann (1841-1913) studied these rays by means of a vacuum spectroscope with fluorite prism and lenses; he also perfected a photographic plate which was much more sensitive to ultra-violet than the ordinary plate in which the gelatine acts as a strong absorber. Ultra-violet radiation excites fluorescence in bodies which possess this property.

Stokes employed a fluorescent screen to explore the ultra-violet spectrum. Rays of ultra-violet when incident on a metal plate charged with negative electricity cause the plate to lose its charge. The effect is one of ionisation; the vibrations liberate electrons from the surface of the metal, and these pass into the surrounding space with their negative charges. If the rays fall on an insulated uncharged metal plate, the latter acquires a positive charge.

This electrical action has been employed in the "photo-electric cell" for the purpose of measuring the intensity of the radiation at different parts of the ultra-violet spectrum; the intensity can also be measured by absorbing the radiation and measuring its heating effect by means of a bolometer or thermopile.

Ultra-violet radiation has important applications in medicine, especially in the treatment of non-pulmonary tuberculosis and of rickets. The natural source of the radiation is the sun. The rays act on the cent nervous system, and cause men stimulation, hence the cheery eff on the spirits of a bright sunny d The rays have very little power penetrating the skin, but are able produce two striking effects, *erythe* or reddening of the skin, and tanni or pigmentation.

Similar effects to those of sunlig can be produced by artificial rad tion, and *actino-therapy* has come in extensive use. The chief sources the artificial rays are electric arcs.

A common type is the enclos arc of a mercury vapour lamp, t envelope of which is of fused quart which does not stop the rays, as gla does. The rays are harmful in exce and should only be used under skill advice. There are many theories the action of the rays. They certain kill bacteria. They also stimula certain chemical actions. The organ compound *ergosterol*, after subjectic to the rays, acquires dietetic prope ties indistinguishable from those vitamin D, the absence of which the cause of rickets. In photograph these same ultra-violet rays effect a greater or lesser degree the sensitiv silver emulsion upon the photograph film. As a result, when the expose film is placed in certain chemicals darkens to different intensities, pr ducing a negative from which th final picture is printed. When th printing-frame is exposed to the su and the paper under the negativ darkens, the same thing is happenin as when the body receives the ray and becomes sun-burned. — BIBLIC GRAPHY: J. A. Crowther, *Ions, Elec trons, and Ionising Radiations*; H. S Allen, *Photo-electricity*. For ligh therapy, see articles by various autho rities in *Nature*, 21st April, 1928.

ULTRA VIRES (Lat., beyon powers). When a corporate body does an act outwith the scope of th powers contained in its charter o necessarily incidental thereto, such a act is said to be *ultra vires* and is void If, for example, a company incor porated under the Companies Act has power by its Memorandum of Association to run only electric tram ways, and its directors commence also to run motor-omnibuses, such a pro ceeding is *ultra vires* the company and invalid. Directors who do an act which is *ultra vires* may render themselves personally liable.

UL'VERSTON. An urban district, seaport, and town of England, in Lancashire, about 1¼ miles from Morecambe Bay, to which there is a canal. It manufactures iron, steel, chemicals, hardware, boots and shoes,

etc., and there is a small shipping trade. Pop. (1931), 9235.

ULYSSES (ū-lis'sēz ; in Gr. *Odysseus*). King of the Island of Ithaca ; he was one of the Greek heroes who engaged in the war against Troy. In returning to his own country after the siege he visited the country of the Lotophagi in North Africa, the Cyclopes in Sicily (*see* POLYPHEMUS), the island of Æolus, king of the winds ; reached the island Ææa, where Circe changed (temporarily) his companions into swine ; visited the infernal regions, where he consulted the soothsayer Tiresias how to return to his country ; passed in safety the coast of the Sirens, and the dangers of Scylla and Charybdis ; remained for seven years with the nymph Calypso after losing all his men ; and at last, after an absence of twenty years, returned to Ithaca.

Here he found his palace occupied and his substance wasted by suitors for the hand of his wife Penelope, but with the aid of his son Telemachus he put them to death. He lived about sixteen years after his return. These adventures of Ulysses are the subject of Homer's *Odyssey*.

UMAN. A town of Ukraine, in the province of Kiev ; the terminus of a branch railway. It is a corn-exporting centre. Pop. 50,500.

Umbelliferæ : Wild Carrot

UMBELLIF'ERÆ. An extensive and important natural order of plants, the flowers of which are almost always in regular compound umbels (*see* INFLORESCENCE). The plants of this order are natives chiefly of the northern parts of the northern hemisphere, and nearly all herbs with fistular furrowed stems and divided leaves ; the fruit consists of two indehiscent ridged carpels united by a commissure. Some are very poisonous, as hemlock and certain others ; others are esculents, as celery, carrots, and parsnips ; many yield aromatics, as caraway, coriander, dill, anise ; a few secrete a fœtid gum-resin, much used in medicine, as asafetida, galbanum, opopanax, and sagapenum.

UMBER. A well-known mineral pigment, of an olive-brown colour in its raw state, but much redder when burnt. It occurs naturally in veins and beds, or is prepared artificially.

UMBRELLA-BIRD. A South American perching bird (*Cephalopterus ornātus*), family Cotingidæ, remarkable for the crest of blue-black feathers rising from the head and curving towards the end of the beak.

Umbrella-bird

UMBRIA. A province of Italy, deriving its name from the Umbri, by whom it was inhabited in ancient times. It now forms the department of Perugia. The Umbri were an important Aryan people akin to the Oscans and the Latins. Area, 3277 sq. miles ; pop. (1931), 694,074.

UMLAUT (Ger., sound-change, from *um* and *laut*). A term applied in comparative philology to the change of a vowel through the influence of a following vowel (*a*, *i*, or *u*). This

sound-change occurs in the Indo-Germanic languages, but is characteristic especially of the Teutonic family. In German *a*, *o*, and *u* are changed into *ä*, *ö*, and *ü*, as in *hand*, *hände*; *sohn*, *söhne*; *bruder*, *brüder*. Traces of umlaut in English are found in *men* and *mice*.

UMTA'LI. A town of Southern Rhodesia, the headquarters of the Beira-Mashonaland Railway, which has repair-shops there. Lead, silver, copper, and iron are worked near the town, which is the centre of Umtali district and the British Manicaland gold-fields. The climate tends towards malaria, and the mean annual rainfall is about 30·6 inches (wet season, November to March); altitude, 3571 feet. Pop. (white), 2300.

UMTATA. A town of Cape Province, South Africa, 120 miles N.E. of King William's Town. It is the capital of Tembuland. Pop. (white), 2000.

UNCINULA. A genus of ascomycetous Fungi, family Erysiphales. *U. spiralis* is the true or powdery vine mildew, formerly known as *Oidium Tuckeri*. This pest readily succumbs to spraying with flowers of sulphur or a solution of potassium sulphide (½ oz. to the gallon).

UNCONFORMABLE. See diagram and definition under GEOLOGY (section *Stratigraphical Geology*).

UNDERCLIFF. *See* WIGHT, ISLE OF.

UNDERSHOT WHEEL. A form of water-wheel with float-boards or vanes fixed to its circumference, and rotated by a stream of running water acting upon it at its lowest point. By the improvements effected by Poncelet in the form of vanes, the efficiency was more than doubled. The water never fills the space between the vanes, and the action is a pure impulse.

UN'DINE. A water-spirit of the female sex, resembling in character the sylphs or spirits of the air, and corresponding somewhat to the naiads of classical mythology. According to Paracelsus, who describes the undines in his *Treatise on Elemental Spirits*, when an undine married a mortal and bore a child she received a soul. One of these spirits is the heroine of a celebrated romance by De la Motte Fouqué (*Undine*, published in 1811).

UNEMPLOYMENT. Absence of employment, usually work that provides a livelihood. The conditions of modern industry, mass production, fashion, machinery, the credit system, and many other factors, have created a great, but varying, amount of unemployment, which presents one of the most formidable problems of t day. No single solution is possib but something may perhaps be do by stimulating demand and reduci hours of labour. As, however, perfect equilibrium between produ tion and consumption can never reached, unemployment is nev likely entirely to disappear.

Since the Great War there has be a great increase in the number unemployed, although this is part accounted for by the greater fullne and accuracy of the figures kept t the various nations. In Great Brita the figure has only rarely fallen belo 2,000,000, and in 1932 it was only little under 3,000,000, or somethin like one-fifth of the working popul tion. In 1932 Germany reporte over 6,600,000 unemployed. For th United States there are no exac figures, but 10,000,000 and eve 12,000,000 were freely mentioned. I 1932 it was stated by the Internationa Labour Office that 30 per cent of th workers were unemployed.

UNEMPLOYMENT INSURANCE. Since 1911 Great Britain has had system of insurance against unem ployment, and a similar scheme ha been in operation in Northern Ireland The contributions payable and th benefits receivable have been altere several times, the last time being i 1931, when the changes made were part of the programme of nationa economy. The scheme applies to al manual workers and to all others who are in receipt of less than £25(a year and are between the ages of 16 and 65, with the exception of two large classes, agricultural labourers and domestic servants. About 13,000,000 persons are insured under the scheme, which is controlled by the Ministry of Labour. The local centres for the payment of benefits are the employment exchanges and the offices of the various trade unions.

The rates of contribution are per week:

	Insured Person	*Employer*
Males	10*d.*	10*d.*
„ 18 to 21 ..	9*d.*	9*d.*
„ 16 to 18 ..	5*d.*	5*d.*
Women	9*d.*	9*d.*
„ 18 to 21 ..	8*d.*	8*d.*
„ 16 to 18 ..	4½*d.*	4½*d.*

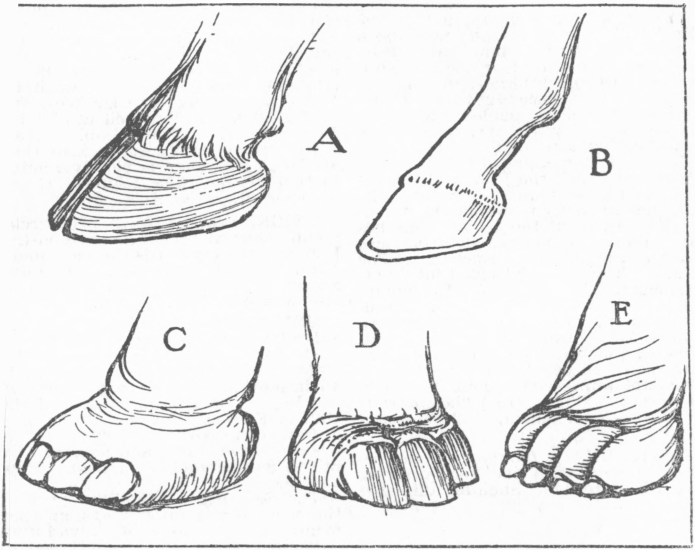
The benefits are: Men 15*s.* 3*d.* per week, and women 12*s.* 6*d.* per week, with smaller sums for those under 21 years old. In addition 8*s.* a week is paid for a wife or other adult dependent and 2*s.* for each child. Benefits will only be paid for 26 weeks, after which the applicant, if still unemployed, must pass a means test.

Owing to the serious increase in unemployment, it was necessary for

State to borrow large sums in ler to maintain the benefits, and 1931 over £100,000,000 had been borrowed. A royal commission s appointed to report on the sub- t, and this issued its first report 1931. One result was that the tional economy scheme included asures to avoid further borrowing, e scheme thus being made solvent.

UNGAVA. A northern district of e province of Quebec, Canada, to which it was annexed in 1912 contemporaneously with the extension of Manitoba northwards to the 60th parallel of latitude, and of Ontario to the shores of Hudson Bay. It is bounded in the south by East Main River, Fox Lake, Ashwanipi Lake, and Hamilton River; on the east by Labrador (a Newfoundland possession); west by Hudson Bay; and north by Hudson Strait and Ungava Bay (with Akpatok Island). The total area prior to annexation was about 354,960 sq. miles.

UNGULATA. The ungulate or hoofed order of mammals. It is subdivided into the following ten suborders, of which those marked * are only represented by extinct types. (1) *Condylarthra. Small American and European forms from the Eocene. They are mostly plantigrade, with five digits to each extremity. The best-known type is the swamp-dwelling Phenacodus, possibly ancestral to horses, etc. (2) *Amblypoda. Large semi-plantigrade Eocene forms, originating in the New World and afterwards spreading into Europe. The feet and toes were short and stumpy. Dinoceras was a huge form possessing three pairs of horns. (3) *Ancylopoda. Large Miocene and Pliocene types widely distributed through Europe, Asia, and North America. The toes were sharply pointed, and five were present on each foot. Chalicotherium, Macrotherium. (4) *Typotheria. Rather small forms with complete clavicles, from the Tertiary of South America. Typotherium. (5) *Toxodontia. Large three-toed forms from the South American Miocene and Pleistocene. Toxodon, Nesodon. (6) Proboscidea. Elephants, including many extinct types, some of which form an evolutionary series. (7) Hyracoidea. The coneys of Africa, Arabia, and Palestine. Hyrax. (8) Perissodactyla. Third digit well-developed, and an odd number of toes on hind foot.



Ungulata

A, Cow. B, Horse. C, Elephant. D, Rhino. E, Hippo.

Tapir, rhinoceros, horse. (9) *Litopterna. Forms somewhat resembling perissodactyles, from Middle Tertiary and Pleistocene of South America. Digits one to five (generally three), of which the third is dominant. Proterotherium, Macrauchenia. (10) Artiodactyla. Even-toed forms, with dominant third and fourth digits. (*a*) Non-Ruminantia. Hippopotamus and swine. (*b*) Ruminantia. Chevrotains; camel and llama; deer; giraffe and okapi; antelopes, oxen, sheep, and goats.

UNIATS. A term applied to the Eastern Christians who have been united to Rome, but have been allowed to retain their local ecclesiastical customs, liturgies, and manner of worship. Since 1204 the Popes have frequently made efforts to extend their sway over the Greek Churches and to unite them to the Church of Rome, and in 1596, at the Synod of Brest, the Roman delegates were successful in persuading the Ruthenian clergy to accept the union.

The clergy of the Uniat Churches are allowed to marry, and they use leavened bread in the Eucharist. The Uniat Churches are divided into : (1) Armenian, (2) Coptic, (3) Ethiopian, (4) Greek (Græco-Rumanian, Græco-Ruthenian, and Græco-Bulgarian), and (5) Syrian (Maronites, Chaldæans, and Malabar-Christians). The largest of these Churches is the Ruthenian, numbering about 4,000,000 adherents. There are Uniat patriarchates at Jerusalem, Antioch, and Cilicia.

UNICORN. A fabulous animal represented as with one horn growing from its forehead. Such an animal is

Unicorn

frequently mentioned by Greek and Roman writers, who generally describe it as a native of India, of the size and form of a horse, the body being white, and a straight horn growing from its forehead. The *reem* of the Hebrews, of which *unicorn* is a mistranslation (Deut., xxxiii., 17, and elsewhere), was probably a urus. It was a two-horned animal. The unicorn is one of the supporters of the royal arms of Great Britain, in that posture termed *salient.* It was taken from the arms of Scotland, which had two unicorns as supporters.

UNION, or TOKELAU GROUP. A British group of coral atolls in the Pacific Ocean, forming part of the Gilbert and Ellice Islands Colony (formed between Nov., 1915, and Feb., 1916). They are under the jurisdiction of New Zealand. The chief islets of the group are Oatafu (Duke of York), Fakaofo (Bowditch), Nuku Nono (Duke of Clarence), and Swain Island, a detached atoll lying farther south. The people (1931, 1048) are of Polynesian extraction, and their language is closely related to that of the Ellice Islands. Copra is exported. Area, 4 sq. miles.

UNION, LA. A town of Murcia, Spain ; served by the Cartagena-Los Blancos Railway. It is the metropolis of an iron and manganese ore-mining region, where argentiferous lead is also worked. Pop. 25,000.

UNION, LA. A department of Salvador, Central America, producing gold and silver. The capital, La Union (San Carlos de la Union), is an important seaport (pop. 7000) on the Bay of La Union, an arm of the Gulf of Fonseca, and lies at the base of Conchagua volcano (6000 feet). It has an active trade, and is served by rail to San Miguel (40 miles). Pop. 15,000.

The San Miguel line is a part of the east-to-west railway system that forms the backbone of Salvadorian communications, and is continued to Coujutepeque, via San Vicente. From Sonsonate (q.v.), Santa Ana and San Salvador City are served. La Ceiba is reached via Ateos, and Santa Tecla and La Libertad via Nueva San Salvador.

UNION OF SOCIALIST SOVIET REPUBLICS. *See* RUSSIA.

UNIONIST. Political party in Great Britain. It originated in 1885 when Gladstone proposed to give Home Rule to Ireland. A number of Liberals, led by the Marquess of Hartington and Joseph Chamberlain, thereupon left the party and called themselves Liberal Unionists because they were determined to maintain the union between England and Ireland. In 1895 they joined the Conservative party in forming a Government, and gradually the two parties became one, and the term Conservative was

ropped for that of Unionist. After he Great War, when Home Rule had eased to be a vital question, there vas a return to the name Conservative. The name Unionist, however, is till used, and the official name for he Central Association of the party s Conservative and Unionist. *See* CONSERVATIVE.

UNITARIANISM. As descriptive of a particular form of religion, the word "Unitarian" was, so far as is known, used for the first time in a decree of the Transylvanian Diet, at Lecsfalva, 25th Oct., 1600, and was ratified by the Transylvanian Unitarians, as the official designation of their Church, at the Complanatio Deesiana in 1638. Seventy years earlier, in 1568, Francis David had pleaded the cause of religious liberty at the Diet of Torda; he it was who became the first bishop of what was to be known as the Unitarian Church of Transylvania and, after 1848, as the Hungarian Unitarian Church.

It was in 1565 that the Polish Anti-Trinitarians became known as the Minor Church, of which the synods, from 1601, met annually in the town of Cracow, where Faustus Socinus had come to reside in 1579.

He became the virtual leader of the Polish Anti-Trinitarian community, and from him derives the epithet "Socinian," which for two centuries and a half was used as a term of opprobrium by those who aimed at vilifying unitarianism; it has also been used by historians as sufficiently indicating the beliefs of English Unitarians, in spite of the fact that, for the most part, English Unitarian thought, whatever stimulus it may have received in its earlier stages from the widespread influence of the Socinian writings, has never more than very partially identified itself with the doctrines of Socinus.

In the year 1660 the Churches of the Polish Brethren (as the Anti-Trinitarians came to be called) were proscribed; always they had been the butt of Jesuit intrigue, and when John Casimir, who had been a cardinal, became King of Poland the extermination of the Minor Church was a foregone conclusion.

In England, in the year 1640, a canon of the Convocation of Canterbury provided for the excommunication of printers, importers, and readers of Socinian books, and in 1648 an ordinance of the Long Parliament made the denial of the Trinity a capital crime. But for the intervention of Cromwell the extreme penalty would have been paid by Paul Best (1590-1657), a direct convert to the anti-trinitarianism of Eastern Europe, and John Biddle (1616-62), who was a Unitarian before he knew the Socinian writings, many of which he afterwards translated into English.

A *Brief History of the Unitarians, called also Socinians* appeared in 1687. Although published anonymously, it is known to have been written by Stephen Nye (1648-1719), a Hertfordshire vicar. At this time the Anti-Trinitarian controversy was being carried on within the Established Church. Thomas Firmin (1632-97), an intelligent philanthropist and one who maintained his communion with the Church, was largely responsible for the cost of issuing the three volumes of Unitarian tracts which came out between 1691 and 1697. Three more volumes were issued after his death.

The Toleration Act of 1689 had excluded from toleration anyone who preached or wrote against the Trinity, whilst a Parliamentary Act of 1698, happily never enforced, made the denial of the Trinitarian doctrine a penal offence. The death of Firmin in 1697 stayed the promoting of his plan for the creating of "Unitarian congregations" as fraternities within the Established Church.

Three-quarters of a century was yet to elapse before there appeared a distinctively Unitarian worship destined to establish itself as a definite part of the religious life of this country. There intervened what has come to be described as the Arian movement, of which, during the eighteenth century, the literary output was considerable.

Of all the books and tracts issued the most memorable was Clarke's *The Scripture Doctrine of the Trinity*. Samuel Clarke was a clergyman of the Established Church, but his writings had a widespread influence among dissenting ministers, who now became the most conspicuous exponents of an anti-trinitarianism which, whilst denying the deity of Christ, yet gave to Him an indefinitely more exalted station than had been conceded in the scheme of Socinus.

A very numerous portion of the congregations of the old dissent went through a period of heterodoxy, and in some of these the lapse from orthodoxy became permanent, and by the end of the eighteenth century or the first decade of the nineteenth they had become Unitarian, accepting, under the influence of the writings of Nathaniel Lardner (1684-1768), Paul Cardale (1705-75), Joseph Priestley (1733-1804), and others, the humanitarian view of the person of Jesus.

Characteristic of the Arians and

their Unitarian successors was their advocacy of the principle of intellectual freedom, their denial that salvation depends on doctrinal agreement, their emphasis on the practical aspects of Christianity, and their pioneer work in critical methods of studying the Bible.

Towards the end of 1773 Theophilus Lindsey attempted to "gather a Church of Unitarian Christians out of the Established Church." Priestley, one of the most eminent of the scientists of the eighteenth century, was well to the front among the dissenters; Lindsey, however, conceived his mission to be to members of the Church of England, and hoped for a considerable Unitarian secession. In April of 1774 he opened his Unitarian chapel in Essex Street, but for the most part it was dissenters who supported this new move; there was, however, a considerable secession of Cambridge divines.

During the half-century leading up to the year 1825, when the British and Foreign Unitarian Association was formed by the bringing together of the then existing Unitarian agencies for propaganda and missionary work, there went on, slowly but surely, the growth and consolidation of the Unitarian movement in Great Britain, although it was not until July, 1813, that the Trinity Act repealed the exclusion from toleration of those who preached or wrote against the doctrine of the Trinity, and finally removed even the possibility of anyone being penalised for disseminating Unitarian views.

In 1825 the American Unitarian Association came into being in Boston, Mass.; American unitarianism grew out of a revolt against the extreme tenets of Calvinism, and was no less concerned to deny the doctrines of human depravity and predestination than to reject the doctrine of the deity of Christ. The name of Channing is associated with this early phase of the movement, which was largely confined to the New England States.

For Lindsey the essential doctrine of unitarianism was that religious worship is to be addressed only to the One True God, the Father; he utterly condemned the worship of Christ. The Arian dissenters, whilst emphasising the supremacy of the Father, varied in their estimate of the person of Christ, believed in His pre-existence, and regarded Him as an exalted Being essentially different from other men; this school of doctrine had by 1825 given way almost entirely to the humanitarian view, which recognised no *essential* difference between Jesus and the rest of humanity.

During the course of the nineteenth century Unitarian thought received significant modifications; the old supernaturalism and dependence on an external revelation, shown in an intense Biblicism, was gradually given up, and the seat of authority in religion was found to be in the spirit of every earnest inquirer and nowhere else.

The first steps along the newer way were made clear by such leaders as John James Tayler (1797-1869), John Hamilton Thom (1808-94), and James Martineau (1805-1900), in England whilst similar service was done in the United States by those, more particularly, who were associated with the so-called Transcendentalist movement—Emerson, Parker, Hedge, and others.

There are, in Great Britain, some 350 congregations commonly regarded as Unitarian. These churches are for the most part managed congregationally. In Northern Ireland there are some 35 Unitarian congregations and a few mission stations governed by the General Synod of the Non-Subscribing Presbyterian Church of Ireland. These congregations seceded from the orthodox Presbyterian Church in 1830.

Most of the members individually profess and call themselves Unitarians, but the Church is known as the Non-Subscribing Presbyterian Church. Its members are slightly more conservative than the Unitarians in Great Britain. There are nearly 500 Unitarian congregations in the United States; there are also a few in Canada.

BIBLIOGRAPHY: G. Bonet-Maury, *Early Sources of English Unitarian Christianity*; Alexander Gordon, *Heads of English Unitarian History*; *Addresses: Biographical and Historical*; W. G. Tarrant, *The Unitarian Movement*; J. E. Carpenter, *James Martineau*; G. Willis Cooke, *Unitarianism in America.*

UNITED FREE CHURCH OF SCOTLAND, THE, was the product of the fusion of various organisations the members of which had from time to time broken away from the Church of Scotland. Established by Act of Parliament, this latter Church always contained two opposing parties: one which favoured the controlling policy of the State, and an evangelical element which contended for liberty of jurisdiction within its own spiritual sphere.

The former acquiesced in the encroachments made upon their freedom of worship and government; the latter resented and resisted the innovations, and rather than submit they seceded and founded independent denominations.

So steady was the movement in this direction that by 1765 over 10,000 persons had left the Church of Scotland. The agitation for a polity untrammelled by State interference continued within the Church, and culminated in the disruption of 1843, when several hundred ministers relinquished their livings and formed themselves into the Church of Scotland Free.

These claimed to carry on the true historic Presbyterian Church, purged of its evils, for the legitimacy of association with the State was not then questioned. The tendency of the smaller outside bodies, however, was towards voluntaryism, and by 1847 most of them had coalesced into the United Presbyterian Church.

Two main streams of religious thought and activity thus ran parallel with the Church of Scotland: the United Presbyterian Church, which became noted for its missionary zeal, and the Free Church, which, well organised and liberally supported, developed into a powerful force throughout the country. The very success of the Free Church tended to weaken the old conception of the value of a State connection, and it was only a question of time before these two Churches approximated sufficiently to make organic union practicable. This occurred in 1900, the name assumed being the United Free Church of Scotland.

It was a notable event in the religious history of Scotland, for, apart from the fact that it signalled the closing up of ancient divisions, it was marked by the dramatic and, for a time, successful claim of a small minority in the Free Church to the entire funds and property of that Church, a matter that had ultimately to be adjusted by Act of Parliament.

The process of evolution towards a national, but not privileged, State Church was not exhausted, both the Church of Scotland and the United Free Church next exploring the possibilities of reunion. Subject to its fundamental principles being safeguarded, the latter expressed its willingness to rejoin the old reformed Kirk, and so to realise that dream of a great free Presbyterian Church which has been cherished for many generations. Legislation in that direction followed.

For a religious body depending for its strength and support on the loyalty and goodwill of its members the record of the United Free Church was very high. Largely by means of its Central Fund, it covered the whole of the mainland and islands of Scotland with a network of agencies ministering to the moral and spiritual needs of the people. It had over 1500 congregations, stations, and missions, with a membership of 528,000, and a total income of £1,500,000. Its three colleges had a world-wide reputation for theological culture.

During the European War 198 ministers acted as chaplains, and the Church's tents and huts rendered good service in the fighting areas. In the foreign field it had the care of 35,000,000 non-Christian people in Arabia, Africa, India, China, and the West Indies; its Livingstonia mission was the pioneer enterprise on Lake Nyasa, and opened up Central Africa to trade and commerce.

Two large additional spheres, on the Gold Coast and in Tanganyika Territory, were undertaken at the request of the British Government. Its overseas European staff, including those engaged in Jewish and Continental work, numbers 480, and the native agents 5000. In 1929 the United Free Church and the Church of Scotland were united, but a small section of former members of the United Free Church united to form the United Free Church (Continuing). (*See* SCOTLAND.)

UNITED KINGDOM. Name given in 1800 to the kingdom of Great Britain and Ireland. The Parliaments of England and Scotland were united in 1707, and the first Parliaments of Great Britain and Ireland met in June, 1801. The latter union was dissolved in 1922, when the Irish Free State was established, and to-day the phrase United Kingdom means the United Kingdom of Great Britain and Northern Ireland, i.e. the areas represented in the Parliament at Westminster. *See* ENGLAND; NORTHERN IRELAND; SCOTLAND; WALES.

UNITED METHODIST CHURCH. English Nonconformist body. It was formed on 26th July, 1907, by the union of three Churches which had seceded at different times from the Methodist body founded by John Wesley—the Methodist New Connection (1797), the Bible Christians (1815), and the Methodist Free Church (1857). With the consummation of Methodist Union in Sept., 1932, the United Methodist Church ceased to have a separate existence.

UNITED PRESBYTERIAN CHURCH. The name adopted by that Scottish Church which was formed by the union of the Secession Church and the Relief Church in May, 1847. The system of Church government differed from that of the Established and Free Churches only in having no intermediate court between the presbyteries and the supreme

court, the latter of which was called a General Synod, and sat once a year. The distinguishing feature of the United Presbyterian Church was that it was a voluntary Church, setting itself against all establishment or endowment of religion by the State. In 1900 it joined the Free Church to form the United Free Church of Scotland.

The Secession Church was founded by Ebenezer Erskine (q.v.). It soon broke up into two sections, Burghers and Anti-burghers. In 1799 each of these bodies divided into two, known as the Auld Lichts and the New Lichts. The Auld Lichts are still represented by the Synod of United Original Seceders. The Relief Church originated in 1761, the most noted amongst its founders being Thomas Gillespie, who had been deposed from the ministry of the Church of Scotland on account of his attitude on the question of patronage.

UNITED PROVINCES (*of Agra and Oudh*). A province of British India, comprising the two divisions of Agra and Oudh, with a total area of 106,248 sq. miles; pop. (1931), 48,408,763.[1]

Physical. Physically, about 54,000 sq. miles, or more than half of the province, is part of the Gangetic Plain. In the southern districts the plain merges in rugged spurs of the Vindhya Mountains, and bounding it on the north is a submontane region lying between the Ganges and the Sarda.

North of the Sarda lies the Central Himálaya, a region of waste and desolation rather than of beauty and grandeur. The whole of the province drains to the Ganges, which traverses it and divides it in two. Among other streams the Jumna and Gogra are important.

People. Hindus form about 80 per cent of the population, and Moslems about 14 per cent. Among the former the chief castes are Chámar, Brahman, Ahír, and Rajput.

Language. The chief language is Urdú (Hindustani), which is also the official tongue, but over a million people living in the hills speak the Central Páhari dialect.

Production. Production is largely agricultural, and is dependent upon the soil and rainfall. In the Himálaya the valley alluvium is cultivated in suitable places, and the other two soils, namely, the Central Indian alluvium (derived from the denudation of the Central Indian Plateau) and the main alluvium of the plain, produce good crops. Staple food-grains, such as rice, wheat, gram, barley, *sorghum*, and maize, are largely raised.

Among oil-seeds the chief is *til* (sesame), but the linseed and castor (grown chiefly as a border to sugar-cane) are also widely cultivated. Cotton is the chief fibre; the opium poppy is produced as a winter crop, and sugar-cane is of great importance. Fruits include the mango, guava, plantain, fig, melon, orange, lime, citron, and custard-apple. Cawnpore is the centre of industry.

Commerce. Oil-seeds are exported to Calcutta, etc., raw cotton to Bombay, etc., for shipment abroad; grain and pulse, opium, sugar (to Rajputana, Central India, Bengal, etc.), and *ghee* (to Calcutta, Rajputana, etc.) are also exported. *See* ROHILKHAND (also known as Bareilly Division).

Communications, Towns, etc. Two great trunk lines of the Oudh & Rohilkhand and the East Indian Railways serve the province, which is covered by a network of branch and other lines. Towns include Agra, Allahabad, Bareilly, Benares, Cawnpore, Lucknow, and Meerut. There are universities at Agra, Lucknow, Benares (Hindu), and Aligarh (Moslem).

UNITED STATES OF AMERICA. A Federal Republic, occupying the whole of the central portion of North America.

Area and Population. The Republic is composed of 48 states and one district (Columbia), besides Alaska and various dependencies. The first census was taken of the thirteen original states in 1790, when the population numbered 3,929,214; the total population in 1930 was 122,775,046,[1] exclusive of the non-contiguous territory as follows:

Division *	Gross Area, sq. Miles	Population (1930)
Alaska (1867) ..	586,400	59,278
Guam (1899) ..	206	19,673 †
Hawaii (1898) ..	6,407	368,336
Panamá Zone (1904)	553	30,980 †
Philippines (1899) ..	114,400	12,590,369 †
Puerto Rico (1899) ..	3,435	1,543,913
Samoa (1900) ..	76	10,055
Virgin Islands (1917)	133	22,012
Wake and Midway Is.	29	—
Total	711,639	14,644,616

* The figures in brackets are the dates of acquisition.
† 1932.

[1] The native states of Rampur and Garhwal (Tehri) are subject to the United Provinces, but are not included in the area, &c., given here. For particulars, see these articles.

[1] Divided into religions, there are roughly 75,000,000 Protestants, 19,000,000 Roman Catholics, 4,000,000 Jews, 607,000 Mormons, and 300,000 Eastern Orthodox. The foreign-born population amounted in 1930 to 13,366,407.

In 1860 there were 4,520,784 Negroes, of whom 3,953,760 were slaves. In 1930 there were 11,891,143 coloured people, all, of course, free. Nationalities include :

Europe :

England	808,672
Scotland	354,323
Wales	60,205
Northern Ireland	178,832
Irish Free State	744,810
Germany	1,608,814
Italy	1,790,424
Poland	1,268,583
Russia	1,153,624

Asia :

Palestine and Syria ..	63,362

America :

Canada	1,278,421
Mexico	23,743

Between 1820 and 1931, 37,859,151 immigrants were admitted :

Year	Total Immigrants	From United Kingdom
1918	110,618	2,847
1921	805,228	79,577
1930	241,700	54,460 *
1931	97,139	16,415 *

* Including the Irish Free State

The total area of the United States, apart from non-contiguous territory, is 3,026,789 sq. miles, of which 2,973,774 miles represent land area. Articles on each of the following 48 states should be consulted : Alabama (Ala.), Arizona (Ariz.), Arkansas (Ark.), California (Cal.), Carolina North (N.C.),* Carolina South (S.C.),* Colorado (Col.), Connecticut (Conn.),* Dakota North (N. Dak.), Dakota South (S. Dak.), Delaware (Del.),* Florida (Fla.), Georgia (Ga.),* Idaho, Illinois (Ill.), Indiana (Ind.), Iowa (Ia.), Kansas (Kan.), Kentucky (Ky.), Louisiana (La.), Maine (Me.), Maryland (Md.),* Massachusetts (Mass.),* Michigan (Mich.), Minnesota (Minn.), Mississippi (Miss.), Missouri (Mo.), Montana (Mont.), Nebraska (Neb.), Nevada (Nev.), New Hampshire (N.H.),* New Jersey (N.J.),* New Mexico (N. Mex.), New York (N.Y.),* Ohio (O.), Oklahoma (Okla.), Oregon (Oreg.), Pennsylvania (Pa.),* Rhode Island (R.I.),* Tennessee (Tenn.), Texas (Tex.), Utah, Vermont (Vt.), Virginia (Va.),* West Virginia (W. Va.), Washington (Wash.), Wisconsin (Wis.),Wyoming (Wyo.). The asterisk (*) indicates one of the original thirteen states of the Union; and the bracketed letters are the official contractions of the state names. The District of Columbia is contracted to D.C.

General Features. The Republic has a coast-line of 15,600 miles, of which 6861 are on the Atlantic, 2281 on the Pacific, and 5750 on the Mexican Gulf. The most important indentations on the Atlantic are Massachusetts Bay ; Long Island Sound, and in connection with it the Bay of New York ; Delaware Bay ; Chesapeake Bay ; Albemarle and Pamlico Sounds ; and the Gulf of Mexico. The Pacific seaboard is deficient in bays, but possesses in that of San Francisco, on the coast of California, one of the largest natural harbours in the world. There are few islands either on the Atlantic or Pacific coasts, the only one of any importance being Long Island.

The country is traversed by two great mountain-systems. The chief of these is what as a whole may be called the Cordilleras, which enters from Mexico, stretches northwards, and is continued into the Dominion of Canada. It has in its broadest parts a breadth of 1000 miles, and includes the ranges known as the Rocky Mountains, Sierra Nevada, Cascade Range, the Coast Ranges, the Blue Mountains, and various lofty plateaus.

The great feature of this system is the Rocky Mountains (q.v.). The other mountain-system is the Appalachian, which stretches parallel to the Atlantic coast almost from the Gulf of Mexico to the St. Lawrence. It consists of a long plateau with various groups and ranges of hills, among which are the White Mountains in New Hampshire, the Green Mountains of Vermont, the Adirondacks of northern New York, the Catskills of south-eastern New York, and the Alleghanies of Pennsylvania.

The great plain lying between these two mountain-systems belongs almost entirely to the basin of the Mississippi-Missouri, which enters the Gulf of Mexico. This, the chief river of the country, has a drainage basin of 1,257,457 sq. miles, and is of immense importance as a highway of internal trade. Various other rivers enter the Mexican Gulf, including the Rio Grande del Norte, which separates the States from Mexico. About 644,000 sq. miles of country is drained to the Pacific, 490,000 to the Atlantic, and 1,684,000 to the Gulf of Mexico (the Mississippi-Missouri being included).

The country west of the Rocky Mountains, belonging to the basin of the Pacific, is drained by the Columbia in the north-west ; the Sacramento, which discharges into the Bay of San Francisco ; and the Colorado, which falls into the Gulf of California. Between the Alleghanies

and the Atlantic the principal rivers are the Hudson, which contributes to form the Harbour of New York; the Delaware, which falls into the bay of that name, and is navigable to Philadelphia; the Potomac, which falls into Chesapeake Bay, and is navigable to Washington; and the Savannah, which enters Savannah Bay.

The chief lakes are Superior, Michigan, Huron, Erie, and Ontario, lying between the United States and Canada and belonging (except Michigan) partly to both, with Lake Champlain, and Great Salt Lake. There is a coast-line of over 3600 miles to the Great Lakes.

Geology and Minerals. Geologically the United States roughly forms two large areas. One extends from the Atlantic to the base of the Rocky Mountains, and is occupied to a large extent by a great basin of Palæozoic formations, including the Cambrian, Silurian, Devonian, and Carboniferous divisions. In the other great geological area, which extends from the base of the Rocky Mountains to the Pacific, the Eozoic and Palæozoic formations which predominate are overlaid by rocks of the Secondary and Tertiary periods.

The United States is the greatest producer of minerals in the world. Coal of all kinds and iron are the chief products. It stands first in the output of coal, copper, iron, lead, petroleum, and salt; only Mexico produces more silver, and only Germany more zinc; and it is one of the chief gold-mining countries. The only notable metal not among its resources is tin.

Of its annual output of coal fully one-fifth is anthracite. The anthracite comes almost wholly from Pennsylvania, which is also the chief producer of bituminous coal and altogether the principal mining State of the Union. Other notable producers of bituminous coal are Illinois, West Virginia, Ohio, Alabama, Indiana, Kentucky, Iowa, Kansas, and Missouri.

About three-fourths of the total output of iron ore is obtained from a number of low ranges of hills near Lake Superior, in Minnesota and Michigan. The ore is smelted chiefly in Pennsylvania, Ohio, and Illinois, where fuel is abundant. Montana, Michigan, and Arizona produce the bulk of the copper; lead comes principally from Idaho, Utah, and Colorado; zinc is mined in Kansas, Missouri, Arkansas, Illinois, and other states. Gold comes chiefly from Colorado, California, and South Dakota, and silver is produced, mainly in Colorado, Montana, Idaho, and South Dakota.

The leading petroleum States California, Ohio, Texas, West Virg Pennsylvania, Indiana, and York; and natural gas, a valu fuel, is produced in several Sta Other minerals worthy of mention granite, marble, phosphate rock, quicksilver, aluminium, antim platinum, nickel, cobalt, mangan graphite, gypsum, limestone, bo asbestos, talc, and mica. S precious stones are also obtained.

Climate, Flora and Fauna. United States, stretching over s a vast area and having such gr tracts of mountain and plain, m necessarily present a great variety climate. The mean annual tempe ture ranges from under 40° to 7 The isotherm of 55° mean ann temperature crosses the centre of country from east to west, pass through St. Louis. Places in latitude of New York and Chica have nearly the same mean tempe ture for the year as the Briti Islands.

The mean annual rainfall for t whole country is about 30 inches, b there is a great difference in t respect between different parts. T rainfall is most abundant on t north-west Pacific coast, on the G coast, and on the high mounta ranges. On the Great Plains it only 10 to 20 inches, and there a large desert stretches in the Rock Mountain region with a rainfall less than 10 inches. The distributio of forests is partly determined b rainfall.

East of the Great Plains the countr is well wooded, but the Great Plai themselves and a great part of t mountain region are almost treeles In Washington, Oregon, and norther California there are extensive forest of valuable conifers, including pine red-wood, and sequoias. The principa trees of the east are white pine, no becoming scarce, yellow pine in sev eral varieties, walnut, chestnut, oak poplar, cherry, spruce, balsam, an hemlock.

Lumbering is a flourishing industry in the Pacific forest region and aroun the great lakes chiefly. There is wid variety in the vegetation, which i semi-tropical in the south and has semi-arctic character in the north The western deserts are characterise by cactuses, the yucca, and the sag brush. Among the principal native animals, some almost exterminated are antelopes, deer, bears, bison o buffalo, the American elk, the big horn or Rocky Mountain sheep, th Rocky Mountain goat, prairie dogs coyotes, wolves, opossums, and jack rabbits. The rattlesnake and othe snakes are notable among reptiles.

Agriculture. The total area occupied as farms in 1930 was 986,771,016 acres approximately, of which 522,395,804 acres were improved land. The number of farms was 6,288,648. The most numerous class of farms is that between 100 and 500 acres, next that between 20 and 50 acres. The great majority of farms were cultivated by owners. Irrigation is absolutely essential to agriculture in the dry central and western regions.

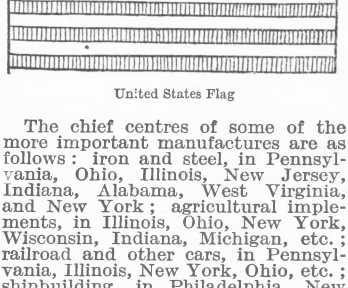
Among cultivated crops the most important are: maize, grown in many of the central States, chiefly in Iowa, Illinois, Kansas, Nebraska, Missouri, Indiana, and Ohio; wheat chiefly in Kansas, Minnesota, the Dakotas, Nebraska, Ohio, Pennsylvania, Indiana, Missouri, Washington, Illinois, and Michigan; oats, chiefly in Illinois, Iowa, Wisconsin, Minnesota; barley is favoured in a very few States; rye, in the north-east; buckwheat, mostly in New York and Pennsylvania; tobacco, principally in Kentucky, North Carolina, Virginia, Wisconsin, Ohio, Tennessee, Connecticut, Pennsylvania, and Maryland; rice, mostly in Louisiana, Texas, South Carolina, and Georgia; cane-sugar, in Louisiana and Texas; cotton, principally in Texas, Georgia, Mississippi, Alabama, South Carolina, Louisiana, Arkansas, North Carolina; beet-sugar, in California, Nebraska, and Utah; sorghum-sugar in Kansas; maple-sugar, in the north-east; besides potatoes, sweet-potatoes, hay, hemp, flax, etc.

Of fruits, the most noteworthy are apples, pears, plums, peaches, oranges, grapes, lemons, pineapples, and bananas. California is the chief fruit-growing State, but Florida is also of importance in this respect. Wine is made in California and other States. The canning of fruits and vegetables is an extensive industry, especially in California, New York, and Maryland.

Horses are largely bred, and mules and asses in the southern States. Horned cattle and sheep are raised in great numbers, hog-rearing forms an important industry, and immense quantities of cheese, butter, and condensed milk are made. Illinois is the chief State for slaughtering and meat-packing, and New York, Wisconsin, and Iowa lead in dairying.

Fisheries. The New England and Middle Atlantic States are the chief fishery zones. The fish taken on the Atlantic coast comprise cod, haddock, mackerel, halibut, herring, shad, whiting, mullet, bass, sturgeon, menhaden, etc., besides oysters, for which Maryland is the principal State. Washington, Oregon, and Alaska have very extensive salmon-fisheries, and export enormous quantities of canned fish. The fisheries are carefully fostered and regulated by Government.

Manufactures. The United States is one of the greatest manufacturing nations. The principal manufacturing States are New York, Pennsylvania, Ohio, Massachusetts, and Illinois. The principal industries are the iron and steel industries, the textile industries, slaughtering and meat-packing, lumbering, flour-milling, the working of copper, lead, and other metals, tanning and the manufacture of boots and shoes, brewing, the manufacture of chemicals, factory dairying, the making of agricultural implements and all kinds of machinery.



United States Flag

The chief centres of some of the more important manufactures are as follows: iron and steel, in Pennsylvania, Ohio, Illinois, New Jersey, Indiana, Alabama, West Virginia, and New York; agricultural implements, in Illinois, Ohio, New York, Wisconsin, Indiana, Michigan, etc.; railroad and other cars, in Pennsylvania, Illinois, New York, Ohio, etc.; shipbuilding, in Philadelphia, New York, Baltimore, etc.; cottons, in Massachusetts (Fall River, Lowell, New Bedford, etc.), the Carolinas, Rhode Island, New Hampshire, Pennsylvania, Georgia, etc.; woollens, in Massachusetts, Pennsylvania, Rhode Island, and New York; flax and linen, in New Jersey and Massachusetts; silk, in New Jersey (Paterson), etc.; slaughtering and meat-packing, in Chicago, Kansas City, Omaha, etc.; flour-milling, in Minneapolis, etc.; leather, in Pennsylvania, Massachusetts, New York, Wisconsin, etc.; boots and shoes, in Massachusetts, New York, Ohio, Pennsylvania, New Hampshire; pottery, in Ohio, Pennsylvania, and New Jersey; chemicals, in New York, Pennsylvania, New Jersey, Michigan; glass, in Pennsylvania, Indiana, New Jersey, Ohio, Illinois, New York, etc.; paper,

in New York, Massachusetts, Pennsylvania, Maine, Ohio, etc.

Commerce. In June, 1932, the imports and exports amounted to 1,730,169,000 and 1,949,249,000 dollars respectively. The principal classes of imports are raw materials, certain articles of food, and manufactured goods; the chief classes of exports are agricultural products and manufactured goods. Among commodities imported are sugar, coffee, chemicals, hides and skins, raw silk, rubber and gutta-percha, cotton goods, wool and woollen goods, silk goods, fruits, iron and steel and their manufactures, tin, tobacco and its manufactures, copper and its manufactures, furs, spirits and wines, tea, leather and its manufactures, earthenware and china, oils, fish, raw cotton, cocoa, glass, paper, etc.

The principal commodities exported are raw cotton (a sixth of the total value), meat and dairy produce, iron and steel and their manufactures, grain and flour, copper and its manufactures, mineral oils, wood and its manufactures, cotton goods, animals, leather and its manufactures, tobacco and its manufactures, oil-cake, agricultural implements, vegetable oils, naval stores, chemicals, fruits and nuts, carriages and cars, paper, fertilisers, furs, rubber goods, books, sugar, glucose, etc.

The principal countries imported from are: Canada, Japan, Britain, Germany, Brazil, British Malaya, Philippine Islands, Cuba, France, China, Colombia, British India, Netherlands, West Indies, Italy, Mexico, etc. The exports are taken chiefly by Britain and Canada, who are the best customers; others are: Germany, France, Italy, Netherlands, Belgium, Mexico, Cuba, China, and Japan.

Britain's principal imports from the United States are: petroleum, raw cotton, brass and copper, wheat and other cereals, wheat-meal and flour, fish, lard, beef, hams, bacon, motor-cars, chemicals, wood and timber, zinc, iron and steel, paraffin wax, and starch; and her principal exports to the United States are: linen goods, cotton goods, woollen goods, wool, jute goods, chemicals, tin, and silk. The United States has a highly protective customs tariff.

Shipping and Ports. The foreign trade of the country, formerly carried on in foreign bottoms, is now mainly the monopoly of Federal ships. In 1932 the strength of the mercantile fleet was 25,156 vessels of 15,838,655 tons, of which 5776 vessels of 12,499,301 tons were steamers. The Atlantic ports receive more than half of the tonnage entered. The principal seaports are: New York (nearly quarter of the whole tonnage), E ton, New Orleans, Philadelp Baltimore, Galveston, San Francis Mobile, Pensacola, Portland (M Savannah, Wilmington (N.C.), a Newport News, besides the lake pc of Detroit, Duluth, Superior, Chica Buffalo, etc.

The principal cotton-shipping po are: Galveston, New Orleans, Sav nah, and New York; wheat is ported chiefly from Galveston, N Orleans, New York, Baltimore, a Superior; wheat-flour mostly fr New York and Baltimore; New Yc and Boston are the chief seaports the export of beef, bacon, and ham petroleum is exported chiefly by N York, Boston, Baltimore, and Phil delphia; cattle are shipped at N York, Boston, Baltimore and Phil delphia principally; New Yor Baltimore, and New Orleans are t leading tobacco ports. The coastin trade is confined by law to Unite States vessels.

Weights and Measures, Currenc etc. The weights and measures a the same as those of Great Britain but the old Winchester wine gallo equal to 0·833 of an imperial gallo the ale gallon, equal to 1·01695 in perial gallon, and the Wincheste bushel, equal to 0·9689 of an imperi bushel, are used instead of the im perial standards, and a cental of 10 lb. is used instead of the cwt. Th short ton of 2000 lb. is used for many purposes. Gold is coined in doubl eagles = 20 dollars, eagles = 10 dol lars, half-eagles, and quarter-eagles

Silver is coined in dollars, half dollars, quarters, and dimes or 1(cents. There is a nickel 5-cent piec and a bronze cent. The par value of the dollar of 100 cents is 49·32*d* (i.e. there are 4·8665 dollars to the £ sterling). The country is divided east to west into time zones, the time in each zone being one hour later than that in the zone to the east of it. These zones have their time described thus: *Eastern Time* (5 hours later than Greenwich), New York and Washington; *Central Time*, Chicago and St. Louis; *Mountain Time*, Denver; *Pacific Time*, San Francisco.

Constitution, Government, etc. The government of the United States is a Federal Republic based on the Constitution of 1787, drawn up by delegates from the thirteen original States, and subsequently amended. The Constitution and modes of administration of the individual States bear a close resemblance to each other. Each State maintains its independence, and by means of a State legislature and executive (vested in a

Governor) has complete management of its own affairs. The combined States have one supreme legislature, which takes the name of Congress, and consists of a Senate and a House of Representatives.

The Senate consists of two members from each State elected by its own legislature for six years, one-third of the whole body being renewable biennially. The House of Representatives consists of members chosen for two years by the people of the several States, in numbers proportioned to their population as ascertained by the decennial census. At present it is composed of 435 members. The annual salary of a Senator or a Representative is 10,000 dollars, with travelling expenses.

Congress meets at least once a year, and its leading powers are to levy taxes, duties, imposts, excises; to provide for the common defence and general welfare of the Union; to regulate commerce with foreign nations and among the several States; to coin money, declare war, raise and maintain an army and navy, etc.

The executive is vested in a President chosen for four years, but eligible for re-election. The electors who vote for the President are chosen by each State, in such manner as its legislature may provide, and are in this capacity known as the Electoral College. The President and Vice-President are chosen by the majority of this College, and in the case of an equality of votes the President is chosen by the House of Representatives, and the Vice-President by the Senate.

The President, who must be a native-born citizen, has the power, in concurrence with two-thirds of the Senate, to make treaties, appoint civil and military officers, levy war, conclude peace, etc. He has even a veto on the laws passed by Congress, at least until they have received the assent of two-thirds of both Houses.

The Vice-President presides in the Senate, and in case of death or permanent disability succeeds the President for the remainder of the term.

The business of the executive is administered by a Cabinet consisting of the Secretary of State, Secretary of War, Secretary of the Navy, Secretary of the Treasury, Postmaster-General, Secretary of the Interior, Attorney-General, Secretary of Agriculture, Secretary of Commerce, and Secretary of Labour, each of whom has an annual salary of 15,000 dollars, and holds office during the pleasure of the President.

The seat of the Federal Government is Washington, capital of the District of Columbia. The judicial powers of the Union are vested in a supreme court, presided over by a chief justice and eight associate judges, while each State appoints its own local judges.

The State legislatures may deal with all matters not expressly reserved for the Federal Government by the Constitution of the United States or falling within restrictions imposed by the State Constitutions. Practically all criminal jurisdiction belongs to the States.

History. The first English colonies within the limits of the Union were settled by two chartered companies, called the Plymouth Company and the London Company. By the latter an expedition was sent out in 1607, and a settlement was made at Jamestown, in the present state of Virginia, while the Plymouth Company established a colony on Massachusetts Bay. Other settlers continuing to arrive, a Colonial Assembly was for the first time convened in 1619.

At this time the foundation of the colonies of New England was laid by the "Pilgrim Fathers," a body of Puritans numbering 100 who sailed from England in the *Mayflower*, and landed in 1620 in Massachusetts Bay, where they established themselves. Then another colony was founded in 1628 at Salem, and in 1630 still another was established in Boston.

Rhode Island was first settled at Providence in 1636 by Roger Williams, who had been driven from Massachusetts for his religious and political opinions. The States of Maryland and Virginia were colonised chiefly by English Roman Catholics and Royalist refugees, while the central States were, to a great extent, settled by Dutch and Swedes.

The most remarkable events of the colonial period were those connected with the wars which Great Britain and her colonies were obliged to wage with France, and which terminated in the cession of Canada, etc., to Great Britain in 1763 by the Peace of Paris at the close of the Seven Years' War.

No sooner was this peace concluded than the British Parliament resolved to increase the revenue by a general stamp duty levied in all the American colonies. Accordingly the Stamp Act of 1765 was passed; but this, after opposition, was repealed next year, Britain still claiming, however, its right to tax. In accordance with this claim a duty, in 1767, was imposed upon tea, paper, glass, etc.; but the colonial opposition was such that three years later the duties were all repealed except the one upon tea.

To such a pass had the opposition

now come that in 1773, when British ships loaded with tea attempted to effect a landing in the port of Boston, a number of the inhabitants, disguised as Indians, seized them and threw the cargoes into the sea. In punishment of this, Parliament passed the Boston Port Bill, which declared that port closed to all commerce, and transferred the seat of colonial government to Salem.

army and navy, with George Washington as commander-in-chief.

On 17th June the British attacked the entrenched position of the colonists on Bunker Hill, which commanded Boston harbour, and captured it, but the following year they retreated to Halifax. This action induced the colonists to continue their resistance, and it was declared by the thirteen States assembled in

From this time it became evident that a conflict was inevitable, and in 1775 hostilities actually commenced when a small British force, sent from Boston to destroy the military stores at Concord, was attacked by the colonists near Lexington, and forced to retreat. Before the end of April the British Governor and army were besieged in Boston by a revolutionary force of 20,000 men; the northern fortresses of Ticonderoga and Crown Point were seized; and a Continental Congress which assembled at Philadelphia took measures to equip an

congress that "the united colonies are, and ought to be, free and independent States; that their political connection with Great Britain is, and ought to be, dissolved."

This resolution was embodied in a Declaration of Independence, drawn up by Jefferson and adopted 4th July, 1776. The British Government now sent an army against the colonists under the command of Sir William Howe, and in a battle on Long Island (Aug., 1776) Washington was defeated with heavy loss. He retreated beyond the Delaware, and in order

to defend Philadelphia, then the capital, was obliged to give battle on the Brandywine, where he was again defeated. Fortune, however, favoured the Americans in the North, where General Burgoyne surrendered to General Gates at Saratoga in Oct., 1777. This induced the French to enter the struggle in the spring of 1778, and subsequently Spain and Holland aided the Americans.

At last the surrender of Lord Cornwallis with his army at Yorktown (1781) to a combined French and American force under Rochambeau and Washington, virtually terminated the war. On 3rd Sept., 1783, Great Britain formally recognised the independence of the United States by a treaty of peace signed at Paris, and in order still further to establish their position the thirteen States met at Philadelphia in 1787, and after four months' deliberation framed a Constitution.

This Constitution, which still remains the basis of the government, came into operation in March, 1789, and George Washington was elected the first President. In 1793 Washington was unanimously re-elected President, but in 1797 he refused a third term. During his administration the States of Vermont, Kentucky, and Tennessee were admitted into the Union.

John Adams was elected second President, and it was while he held office that France made war upon the Republic, the fighting taking place chiefly at sea. In 1800 the seat of government was transferred from New York to Washington. In 1802 Ohio was added to the Union, and in the next year the great territory of Louisiana was purchased from France.

Great Britain still claimed the allegiance of American naturalised subjects, and the right to search American vessels for British seamen. In 1807 the British frigate *Leopard* overhauled the United States frigate *Chesapeake* near the entrance to Chesapeake Bay, compelled her to surrender, and took off four of her men. Reparation was asked in vain, and in June, 1812, war was declared against Britain.

In 1814 peace was arranged. After this the chief historical events were the wars against the southern Indian tribes and the acquisition of Florida from the Spanish (1819); the annexation of Texas, which led to a war with Mexico (1845); and the acquisition of New Mexico and Upper California, ceded to the United States on payment of the sum of 15,000,000 dollars to Mexico.

The insurrection (1859) at Harper's Ferry brought the question of the abolition of slavery to a crisis. The presidential election of 1860 turned to a great extent upon this question, and when Abraham Lincoln, the Republican candidate, was elected, the slave-holding States considered themselves defeated, and South Carolina, Mississippi, Florida, Alabama, Georgia, Louisiana, and Texas formally seceded from the Union.

These States formed themselves into a Southern Confederation (4th Feb., 1861), with Jefferson Davis as President, and they were subsequently joined, after hostilities had begun, by Virginia, North Carolina, Tennessee, and Arkansas. The custom-houses, arsenals, and United States buildings generally were seized and occupied by the Confederates in their own States, and every preparation made to organise a separate Government. War was inevitable, and the first blow was struck on 12th April, 1861, the Confederates proceeding to bombard Fort Sumter, which was forced to surrender.

The four years' war was ended in favour of the Federals (*see* LINCOLN; LEE; GRANT; JACKSON; DAVIS; SLAVERY). In the course of the war the abolition of slavery was proclaimed by President Lincoln, who had just entered (April, 1865) upon his second term as President when he was assassinated.

As the States returned to their allegiance to the Union they were after a time readmitted to their State and national privileges. The election of General Grant to the presidency in 1869 served, in some measure, to consolidate matters. An amendment to the national Constitution was proclaimed in March, 1870, and provided that no difference of race, colour, education, or religion shall debar any person from the rights of citizenship in any of the States. This question of equal rights as between the negro and the white population is still beset with dangers.

The Treaty of Washington (1871) provided for the settlement by arbitration of three outstanding disputes with Great Britain. One of them concerned the claims based upon the depredations of the Confederate vessel *Alabama* (q.v.); the second bore on the disputed frontier between British and United States territory in the neighbourhood of Vancouver Island; and both of these were settled in favour of the United States. The third concerned the Canadian fisheries, and was decided against the United States.

President Grant was succeeded in the presidency by R. B. Hayes (1877-81), who ended the period of reconstruction in the South by withdraw-

ing all Federal troops in 1877. At the presidential election of 1880 the Republicans elected their candidate, James A. Garfield (q.v.). In 1884 the Democrats were successful in securing the election of Grover Cleveland (q.v.). The Republican, Benjamin Harrison (q.v.), was elected President in 1888. Cleveland was again elected in 1892, and began his second term in 1893 (*see* BEHRING'S SEA; SEAL).

In his message of 17th Dec., 1895, President Cleveland brought his country to the verge of war with Britain by claiming to interfere, on the basis of the Monroe Doctrine, in the boundary dispute between Venezuela and British Guiana, but an agreement to submit it to arbitration was reached in the following year. The presidential election of 1896 resulted in the election of the Republican, M'Kinley (q.v.). Hawaii was annexed in 1897. The Spanish-American War of 1898, arising out of the Cuban revolution, ended in a hollow defeat of Spain, and by the Treaty of Paris (1899) Spain relinquished all claim to Cuba and ceded to the United States Porto Rico, Guam, and the Philippines.

The Filipinos refused to accept the cession of their islands and formed a republican government, but after desultory fighting the Union asserted its authority and established civil government (*see* TAFT). The presidential election of 1900 was again won by M'Kinley. In Sept., 1901, President M'Kinley was shot by an anarchist, and his place was taken by the Vice-President, Theodore Roosevelt (q.v.).

Roosevelt's administration was marked by a considerable activity of the Federal Government against combinations in restraint of trade, and his chief activity was directed against trusts. The Panama Canal Zone was purchased in 1904. The San Francisco earthquake occurred in April, 1906, whilst on 29th Sept. of the same year the United States intervened in Cuba and established a provisional government in the country.

Roosevelt was succeeded in office by William Howard Taft in 1909. The new President immediately summoned Congress for the purpose of revising the tariff. A new protective tariff, in the interests of manufacturers, was inaugurated, and the Payne-Aldrich Tariff Act was adopted on 5th Aug., 1909. In 1909 the United States forces of occupation were withdrawn from Cuba, and the differences with Venezuela were settled. During the electoral campaign of 1912 three Republicans, Taft, Roosevelt, and La Follette were seeking nomination, and this split led to the victor of the Democratic candidate, Woodrow Wilson, who was elected President.

The President's attention was much occupied by foreign relations In 1914 the European War broke out and although America at once declared its neutrality, the United States lent money and sold munitions to the Allies. Wilson was re-elected President in 1916, and immediately turned his attention to the situation in Europe. His efforts to bring about a speedy peace proved futile, and on 3rd Feb., 1917, the United States severed diplomatic relations with Germany, war subsequently being declared on 6th April (*see* LEAGUE OF NATIONS; EUROPEAN WAR; WILSON).

President Wilson was succeeded in office by the Republican Harding (q.v.), who died in Aug., 1923, and was succeeded by the Vice-President, Calvin Coolidge (q.v.), who was re-appointed in 1924. His successor, elected in 1928, was Herbert Clark Hoover. His advent to office (March, 1929) signalled the collapse of "Coolidge prosperity," and his four years' administration bore the brunt of the economic crisis which involved America along with the rest of the world from 1929 to the present year (1933). The Virgin Islands (q.v.) were purchased from Denmark in 1917. In 1920 two amendments to the Constitution came into force—one (the 19th amendment) granting the franchise to women, the other (the 18th) prohibiting the manufacture, sale, and transportation of intoxicating liquor (defined in the Volstead Act as all liquors containing more than one-half of one per cent of alcohol) throughout the United States. Prohibition (q.v.) remained the policy of the country—it can hardly be said to have been in force—until the election of President Franklin Roosevelt (q.v.) in the 1932 election brought a modification of the law and permitted the use of beers considerably stronger than those permitted under the Volstead Act; but the 18th amendment has yet to be repealed. In 1924 an Immigration Bill was passed which restricted the entry of the nationals of other countries to a quota of 2 per cent of their number already resident in the United States. This measure affected the entrance of Japanese into the U.S.A., and there was considerable friction with Japan as a result.

America's insistence on the repayment of war debts was the cause of much trouble with her debtors. In the post-war years the United States took part in many disarmament and limitation of armament conferences.

Both the War Debts problem and the question of America's foreign relations in general entered upon a new phase with the election of Franklin Delano Roosevelt (q.v.) in 1932. Belonging, like Woodrow Wilson, to the Democratic Party, he displayed from the first day of office an extraordinary vigour and promptitude in laying down and carrying out a policy aiming at the reconstruction of economic life and the settlement of vexed international problems in which the United States were concerned. Visits were paid to him in the first few weeks by the leading statesmen of Europe, including the British Prime Minister (Mr. Ramsay MacDonald) (q.v.), who also had crossed the Atlantic to see his predecessor. He showed himself, however, to be strongly opposed to the cancellation of war debts, though willing to discuss with each country a revision of the terms upon which these debts were being paid. His Government, moreover, participated in the World Monetary and Economic Conference, convoked by the League of Nations, which met in London in the summer of 1933.—BIBLIOGRAPHY; J. C. Ridpath, *History of the United States from Original Times*; J. S. Bassett, *Short History of the United States*; W. Wilson, *A History of the American People*.

Literature. For a period of over 150 years the literature of the United States was nothing more than a colonial offshoot of English literature. The Englishmen who had colonised the American shores of the Atlantic naturally continued to follow the literary fashions of the mother-country. For the last century or more, however, the literature of the United States has been the product of an independent nation.

The divergence between American and English literary productions grows wider from day to day, and American writers are more and more expressing the national American life and spirit. What distinguishes the literature of the United States from that of other nations is the fact that it had no infancy. Primitive epics and chants, myths and legends are wanting in American literature.

American literature may be divided into four periods: the colonial period (1607-1765), the revolutionary period (1765-1815), the period of national expansion (1815-37), and the modern period (from 1837 onwards).

The colonial period of American literature was not productive. History, biography, and theology were the subjects to which the writers of this period turned their attention. It was, however, poetry which marked the first awakening of the literary activity of the settlers. The first literary work of any consequence done in the United States was a translation of Ovid's *Metamorphoses* by George Sandys, written in Virginia in 1620, and published in London in 1626. The first published book was a Puritan edition of the *Psalms* (Cambridge, United States, 1640).

The journals and annals of John Winthrop (1588-1649), Governor of Massachusetts; Edward Winslow (1595-1655), Governor of Plymouth Colony; Nathaniel Morton (1613-85), etc., have been valuable to the historian. The most notable of the earlier writers were theologians, such as Increase and Cotton Mather, Roger Williams, and above all Jonathan Edwards.

The succeeding or revolutionary period was one of strife and combat, and the literature produced between 1765 and 1815 was chiefly a literature of propaganda, of arguments and persuasion. Both the colonial and revolutionary periods are distinguished by a predominance of works dealing with contemporary politics and applied law over works of imagination and pure reasoning. The aim of literature was still a practical one, and *art for art's sake* was as yet unknown. In any case, the poetry and fiction produced in America during the eighteenth century did not penetrate the consciousness of Europe.

The principal writers of the revolutionary period were: James Otis (1725-83), Josiah Quincy (1744-75), John Adams (1735-1826), Thomas Jefferson (1743-1826), Alexander Hamilton (1757-1804), John Jay (1745-1829), James Madison (1751-1836), and above all the statesman and scientist Benjamin Franklin (1706-90). Of historical writings belonging to this period there were the *History of New England* by Hannah Adams, of the American Revolution by William Gordon and David Ramsay, and the *Annals of America* by Abiel Holmes. Philology was represented at this time by Lindley Murray (1745-1826), and the compiler of the famous dictionary, Noah Webster (1758-1843).

Among the theologians were the younger Jonathan Edwards (1745-1801), Samuel Hopkins (1721-1803), Timothy Dwight (1752-1817), Bishop W. White (1747-1836), John Murray (1741-1815), and J. S. Buckminster (1784-1812). The list of poets includes Philip Freneau (1752-1832), John Trumbull (1750-1831), and Joel Barlow (1755-1812). The first well-known novelist was Charles Brockden Brown (1771-1810).

Since the beginning of the nine-

teenth century the number of American writers has enormously increased, and several of them have obtained a world-wide reputation. Nearly all branches of literary art are represented by works of a more or less adequate and characteristic kind, and some new materials and forms notably the so-called American humour, have been added to the Old-World stock.

The first American writer to become really popular on the European side of the Atlantic was Washington Irving (1783-1859), author of *Knickerbocker's History of New York* (1808). After him came James Fenimore Cooper (1789-1851), who obtained a great reputation by his novels of American-Indian and of sea life, such as *The Last of the Mohicans*, *The Red Rover*, etc.

He was far surpassed by Nathaniel Hawthorne (1804-64), one of the most original writers of America, author of *The Scarlet Letter* (1850) and *The House of the Seven Gables* (1851). Henry D. Thoreau (1817-62), author of *Walden*, is at the head of a class of writers on nature. William E. Channing (1780-1842) and Theodore Parker (1810-60) were among the foremost leaders of the liberal movement in theology and religion. At the head of the so-called Transcendentalist group of writers was Ralph Waldo Emerson (q.v.).

The foremost names in American poetry are: William Cullen Bryant (1794-1878), whose works have much of Wordsworth's manner; John Greenleaf Whittier (1807-92); Henry Wadsworth Longfellow (q.v.); Edgar Allan Poe (q.v.); James Russell Lowell (1819-91), author of *The Biglow Papers* (1848); and Walt Whitman (q.v.), who boldly challenged the accepted poetical conventions, and sought to inculcate a lofty conception of democracy. Other poets are: E. C. Stedman, R. H. Stoddard (1825-1903), Richard Watson, E. A. Robinson (1869), L. V. Ledoux (1880), and Percy Mackaye (1875).

The novelists and story-writers are numerous, and many of them are much read outside of America. In addition to Washington Irving, Fenimore Cooper, and Nathaniel Hawthorne, we can only mention a few: Mrs. Harriet Beecher Stowe; Bret Harte; William D. Howells; Henry James (1843-1916), who relied much on psychological analysis; F. Marion Crawford (1854-1909); Stephen Crane (1870-1900); Gertrude Atherton; Winston Churchill (1871); Mary Johnston (1870); David Graham Phillips (1867-1911); Lew Wallace (1827-1905); Mary Noailles Murfree (Charles Egbert Craddock); Robert Herrick (1868); O. Henry (Sydney Porter); Jack London (1876-1916); Sinclair Lewis (1885); James Branch Cabell (1879); and Thornton Wilder (1897).

Of American humorists the best known are: Charles Farrar Browne (Artemus Ward), Henry W. Shaw (Josh Billings), Samuel L. Clemens (Mark Twain), David Ross Locke (Petroleum V. Nasby), and Peter Dunne (Mr. Dooley). Among leading American historians are: George Bancroft (1800-91), W. H. Prescott (1796-1859), J. L. Motley (1814-77), George Ticknor (1791-1871), and Woodrow Wilson (q.v.).

Of American literary critics we may mention: Brander Matthews, G. E. Woodberry, James Huneker, and P. E. More. The essay was cultivated in America by Emerson, J. R. Lowell, O. W. Holmes (1809-94), G. W. Curtis (1824-92), T. B. Aldrich (1836-1907), and John Burroughs (1837-1921).—BIBLIOGRAPHY: W. P. Trent, *History of American Literature*; T. Stanton, *A Manual of American Literature*; Duyckincks, *Cyclopœdia of American Literature*; *The Cambridge History of American Literature*.

UNIVERSE. The whole system of created things. Man has always speculated on its nature, extent and the means of its creation. Until the seventeenth century the earth was considered as the centre, with the sun, moon, and stars revolving round it. In 1632, however, Galileo showed that the earth moved round the sun, and the work of Newton and Kepler led to the accurate forecasting of the movement of all the planetary bodies.

The improvement of the telescope led to the discovery of more and more stars, and spectroscopy enabled their distance and constitution to be investigated. Now, astronomers estimate that the universe contains at least 2000 million stars, the nearest being 25,500,000,000,000 miles from the earth, this being also about the average distance separating one star from the next. Many of the elements found on the earth have been detected in the stars, and it is probable that some stars are themselves centres of planetary systems.

The extent of the universe has caused much philosophical difficulty. Einstein's theory of relativity led to experimental proof that light travels in a curved path, which if prolonged far enough, will return to its starting point, and it is in this sense that the universe is now considered finite but boundless. *See* SPACE.

There is some evidence to show that the material bodies of the universe have been created by a slow process

of evolution, stars forming by concentration from nebulæ, and planets by the cooling of portions of the stars. *See* THE MYSTERIOUS UNIVERSE and other books by Sir J. H. Jeans (q.v.).

UNIVERSITY. The word "university" means to-day a corporation of teachers and students which has a recognised power and authority to grant degrees under certain defined conditions, but the term has in itself no such significance, and, indeed, no meaning beyond that of an association. *Universitas vestra* was a phrase in common use in the Middle Ages for addressing a number of persons, and it meant no more than "all of you." Universitas was not the original term employed to describe what is now called a university.

When the European universities originated during the twelfth-century revival of learning, the schools to which students crowded to study under the guidance of learned men were known as *studia generalia*. There were great teachers of law at Bologna, and a studium collected around them, while teachers of theology and philosophy created a studium at Paris. The movement spread, and by the latter half of the thirteenth century there was a large number of rival schools claiming the title of studia generalia, each of them divided into a number of faculties—arts, law, medicine, and divinity. Some form of definition became necessary if the term studium generale was to be preserved from losing any real significance by being applied to insignificant schools. The distinction ultimately adopted was that a studium generale must be authorised by the Pope or the emperor, who alone could confer the *jus ubique docendi*, a privilege by which a teacher licensed by one studium generale had the right of teaching in any other. This licence consisted in the conferment of the degree of doctor or master, which were at first synonymous, though the doctorate afterwards came to signify a higher degree.

Universitas. The substitution of the word *universitas* for the term *studium generale* came about through the authority which was gradually acquired by associations or guilds within the studium. In Italy guilds or societies among the students, *universitates studentorum*, came, owing to local conditions in the Italian city-states, to be the governing body of the studium, the doctors or masters possessing scarcely any power beyond that of examining for and conferring degrees, and this form of constitution was followed in Spain and in parts of France.

The universitas thus came to supersede studium generale as the title of the institution which it governed.

In Paris and in England the ruling guild or universitas was composed not of the students but of the masters, and it similarly replaced the older name. Studium generale always occurred in Papal Bulls for the foundation of a seat of learning, but universitas was the term in actual use. A mediæval university was therefore a society of teachers and scholars, possessing an authority acknowledged all over Europe, governed by some of its own members, and granting degrees or licences to teach. The distinction between universities of students and universities of masters was most important from the twelfth century to the fifteenth, after which there were changes in the constitution of the Italian universities.

College. Another form of institution, known as a college, developed in most of the early universities. The beginnings of the college may be traced to the conditions which made it desirable for the younger members of a university to live together. They were all, technically, clerks, and were possessed of the legal privileges of the clergy, though by no means all of them intended to proceed to Holy Orders. In addition to the ordinary difficulties and temptations which beset youths in a mediæval town, they had to meet the hostility of the townsmen, and were quite ready to join in the quarrel between town and gown. In Italy, where the presence of a university was important for the trade of a small city-state, this hostility was kept in check, and the students, through their universitas, presided over by a student-rector, were quite capable of taking care of themselves. They were mostly foreigners, and they were divided into nations, according to the place of their birth, and the nations afforded additional protection to their members.

In Paris and in England the hostility of town and gown was much stronger, and the students were not the rulers of the university, nor did their organisation into nations possess the same significance when the large majority of them were of one and the same nationality. Students at Oxford formed themselves into small clubs or societies for the sake of protection, economy, and social intercourse. Each of these houses or halls elected its own head and replaced him as the members chose. They made rules to govern their own societies, and the university did not at first interfere, though it afterwards insisted that every head of a hall should be a master of arts.

The development of the unofficial hall into the corporate college came about through the generosity of the pious donor, who endowed a hall and, along with his endowments, gave statutes and regulations, and obtained legal sanction for the foundation of a corporation. The student whose hall passed into a college remained under the authority of the university, which determined the length of the necessary residence and the subjects of study and examination, and conferred degrees; but he no longer shared with his fellows the regulation of their daily domestic life.

Undergraduate members of a college were under the discipline of the head and the fellows, who were associated with the head in its government, and the rules administered by the governing body were prescribed in the statutes made by the founder. No conversation was permitted in English, all kinds of games and amusements were forbidden, and other regulations prohibited the carrying of arms, unpunctuality, talking or reading during meals (instead of listening to a passage from the Bible, which was read aloud), bringing strangers into college, absence without permission, and similar offences.

As time went on, college discipline became more strict, and the ordinary punishments, which at first had taken the form of the withdrawal of allowances for food, came to include the infliction of a flogging, even at the age of eighteen or twenty. The provision made by founders for their students also became more elaborate; the first college buildings were, with one or two exceptions, merely dwelling-houses bought for the purpose, but later founders erected magnificent buildings and gave more splendid endowments. The college came to be more than a mere living-place; it also provided instruction for its members, and college teaching largely superseded the teaching given by the university. As time went on, the influence of the college system led the university to prescribe a strict code of regulations for students who were not members of a college but still lived in independent halls.

The pre-eminence among universities in point of date belongs to Bologna, the 800th anniversary of which was celebrated in 1888. It is the archetype of the student-universities. The archetype of the master-universities was Paris. It developed from the cathedral-school of the city, and throughout its history the chancellor of the church of Notre-Dame had considerable authority. The date of its foundation cannot be definitely fixed, but it may be assigned to the second half of the twelfth century.

Oxford. The third great university in point of date is Oxford. Its origin is also largely conjectural, and a legend which traced its foundation to King Alfred was not entirely abandoned until the nineteenth century. It probably originated in a migration of English scholars from France after 1167, in obedience to an edict issued by Henry II. during his quarrel with Becket. The college system, characteristic of Oxford to the present day, is also found at an earlier date in Paris than in England. The oldest Oxford college is Balliol, established before 1266, for although University College has a traditional and technical precedence, it does not seem to have come into actual existence before 1280. The first founder to erect a special building for the purpose of a college was Walter de Merton, whose foundation may be traced back as far as 1263, though not in complete form. The statutes of Merton College became the model for the foundation of subsequent colleges—Exeter (1314-6), Oriel (1324), and the Queen's (1341). In 1379 William of Wykeham founded New College on an unprecedented scale of magnificence, and his statutes superseded Walter de Merton's as the general model.

The other pre-Reformation colleges were Lincoln (1429), All Souls (1438), Magdalen (1445), Brasenose (1509), Corpus Christi (1516), and Christ Church, begun by Wolsey as Cardinal College and ultimately founded by Henry VIII. in 1532. All these were colleges for the secular clergy, and their members sacrificed their positions by joining any of the monastic or religious orders; but up to the Reformation several monasteries maintained separate colleges at Oxford for the instruction of their own members, and some of these were subsequently refounded as ordinary colleges.

The impulse towards college-founding persisted until the first quarter of the seventeenth century; Trinity was founded in 1554, St. John's in 1555, Jesus in 1571, Wadham in 1613, and Pembroke in 1624. Only one college is of eighteenth-century foundation—Worcester (1714)—and two belong to the nineteenth—Keble (1869), and Hertford (1874), a restoration of an older institution.

Only one of the ancient public halls survives—St. Edmund Hall, which traces its history as far back as 1269. Up to the last quarter of the fifteenth century the large majority of Oxford students were members of halls, for the residents in colleges were strictly limited to the small numbers actually on the foundation and supported by

the endowments; but about that date the colleges began to take additional members, who paid for their board, lodging, and instruction. and the number of halls consequently decreased. Until comparatively recent years every member of the university had to be a member of a college or of a public hall, but the increase of numbers in the nineteenth century led first to the granting of permission to masters of arts to keep private halls, and in 1868 to the recognition of a body of non-collegiate students supervised by a delegacy appointed by the university. Cecil Rhodes, the South African statesman, on his death in 1902, bequeathed some six million pounds for the founding of Rhodes Scholarships at Oxford. Thirty-four scholars come each year from the British Empire, thirty-two from the United States, and two from Germany. Imperial and American students hold their scholarships for three years, the Germans for two.

Cambridge. The history of Cambridge is similar to that of Oxford. Its origin has also been ascribed by legend to a very early date, but it probably owed its existence to a migration from Oxford in 1209. The college system was introduced in Cambridge about the same time as in Oxford. The earliest college, Peterhouse (1284), was followed by Clare (1326), Pembroke (1347), Gonville (1348, refounded by Dr. Caius in 1558), Trinity Hall (1350), Corpus Christi (1352), King's (1441—the most magnificent of mediæval foundations), Queens' (1448), St. Catharine's (1473), Jesus (1496), Christ's (1505), St. John's (1511), Magdalene (1542), Trinity (1546), Emmanuel (1584), Sidney-Sussex (1596), and Downing (1800). The halls are Fitzwilliam and Selwyn. Girton and Newnham colleges for women, though not part of the university, work in association with it. Non-collegiate students have been admitted to Cambridge since 1869. *See* CAMBRIDGE UNIVERSITY.

Other Universities in England. England possessed only its two ancient universities until the nineteenth century. The University of Durham, founded in 1832, and the University of London, founded in 1836 and about to be consolidated in a modern building (the foundation stone of which was laid by the King in June, 1933), were the pioneers of the newer English universities, many of which developed out of university colleges, which originally had no power of granting degrees. There are now seven universities of comparatively recent date—Manchester and Liverpool, each of which, in its present form, dates from 1903, Birmingham (1900), Leeds (1904), Sheffield (1905), Bristol (1909), and Reading (1926). There are university colleges at Exeter, Southampton, Hull, Leicester, Nottingham, Cheltenham, and also at Bristol, London, Manchester, and Newcastle, these four being allied to universities. At none of the later English universities, except Durham, was the college system introduced as a feature of the original foundation, but halls of residence exist in most of them. The University of Wales was founded in 1893 by the incorporation of three chief constituent colleges—Aberystwyth (1872), Cardiff (1883), and Bangor (1884). In addition to these colleges there is the University College of Swansea, and St. David's College at Lampeter, which is affiliated to Oxford and Cambridge.

Scotland. Scotland possesses three pre-Reformation universities — St. Andrews (1411), Glasgow (1451), and Aberdeen (1495). In constitution the Scottish universities resembled the student-universities, inasmuch as their officers included an elected rector, but the head of the university was the chancellor, as in the master-universities, and the students were always under the government of the masters. The college system was introduced at St. Andrews, where lack of endowments checked its development, though three colleges were founded, and at Aberdeen, where only one college was founded, and it naturally became synonymous with the university. At Glasgow no college was founded, but a pedagogy or boarding-house established by the Faculty of Arts became the principal feature of the university, and was ultimately identified with it. This development led to the emergence of a characteristically Scottish office, the principalship, the principal regent of the pedagogy becoming principal of Glasgow, and the principal of King's College becoming the efficient head of the University of Aberdeen.

Two universities were founded after the Reformation, Edinburgh in 1584, and Marischal College, Aberdeen, in 1593, the latter preserving a separate existence until its amalgamation with the university and King's College in 1860. Collegiate residence was never introduced at Edinburgh, and it had died out elsewhere in Scotland by the beginning of the nineteenth century. A new constitution was devised for the Scottish universities in 1858, and was remodelled in 1889.

Ireland. In Ireland the University of Dublin (Trinity College), founded in 1591, was the only University until the nineteenth century, when institutions were established which have

developed into the National University in the Free State, with colleges at Dublin, Cork, and Galway, and the Queen's University of Belfast in Northern Ireland.

Women Students. Up to recent years women students were excluded from all the British universities. They were admitted to the Scottish universities in 1892, and since that date have been received as full members by all the universities except Cambridge.

Foreign. The Italian universities of the Middle Ages were numerous, and included, besides Bologna, Salerno (a medical school older than Bologna), Padua, Siena, Naples, Rome, Perugia, Pisa, Florence, Pavia, and Turin. In France the universities next in antiquity to Paris were Orléans, Angers, and Toulouse, all founded in the first half of the thirteenth century. Four universities (including Avignon and Grenoble) date from the fourteenth century, and Aix, Poitiers, Bordeaux, Nantes, and four others belong to the fifteenth century. Some Protestant French universities were established after the Reformation. The University of Paris exerted a profound influence in the history of Europe up to the Reformation, and in the history of France up to the great French Revolution, when all French universities and colleges were dissolved by a decree of the Convention. In the nineteenth century academic education was controlled by the Université de France, really a State department, but in recent years some of the universities (including Paris) have been revived.

There were some important mediæval universities in Spain and Portugal, including Salamanca (founded before 1230), Lisbon (1290), Barcelona (1450), and Valencia (1500). Germany was late in establishing universities. The first was Prague (1348), followed by Vienna (1365), Erfurt (1379), Heidelberg (1385), and Cologne (1388). Eleven foundations were made in Germany and the Low Countries in the fifteenth century, including Leipzig (1409), Louvain (1425), Mainz (1476), and Tübingen (1477), to which may be added Wittenberg (1502). In Northern Europe the most important universities were Cracow in Poland (1364), Uppsala in Sweden (1477), and Copenhagen (1477).

After the Reformation the most important new foundations were in Holland, which, after the vindication of its independence, rapidly acquired a great reputation for learning, and the Universities of Leyden (1575), Groningen (1614), and Utrecht (1634) were among the most famous in seventeenth-century Europe. In the more modern movement for t establishment of universities G many took the foremost place. T German Reformation had alrea produced the Universities of Marbu (1527), Königsberg (1544), and Je (1558), and from the end of t seventeenth century the Germ states started upon a new era university-founding, illustrated Halle (1693), Göttingen (1736), I langen (1743), Berlin (1810), a Bonn (1818). The foundation Berlin University marks an impo tant era in the history of the Germ universities, which, liberally endow by the State, came in the course the nineteenth century to enjoy pre-eminent reputation.

U.S.A. The oldest Universities the United States are Harvard (163 and Yale (1701); and some oth colleges, including King's (now Colu bia), New Jersey (now Princeto Pennsylvania, and William and Mar existed in the colonial period. T nineteenth century witnessed a ve large extension of the university sy tem, and there are now 1078 inst tutions described as universitie colleges, or professional schools, b only a small proportion of these a of recognised university standing.

Overseas Dominions. There h been a similar development in t British overseas dominions. Canad possesses twenty-three universities, which the most famous are Toront M'Gill (Montreal), Dalhousie (Hal fax), and Laval (Quebec), and a larg number of university colleges. I Australia there are universities Melbourne, Sydney, Adelaide, an Perth, and there is also a Universit of New Zealand, with four constituer colleges.

In South Africa the University the Cape of Good Hope, establishe in 1873, has been succeeded by th University of South Africa, wit colleges at Grahamstown, Wellingto Bloemfontein, Pietermaritzburg, an Potchefstroom; and there is also th University of Cape Town (a develop ment of the South African College founded in 1829), and the Universitie of Stellenbosch, Witwatersrand, an Pretoria (incorporated, 1930). Ther are sixteen universities in India, in cluding Calcutta, Madras, Bombay and Allahabad.—BIBLIOGRAPHY; H Rashdall, *The Universities of Europ in the Middle Ages*; R. S. Rait, *Lif in the Mediæval University*; M Arnold, *Schools and Universities o the Continent*; *Minerva* (a Year Boo of the universities of the world).

UNIVERSITY COLLEGE (Oxford The oldest in the university, founde about 1253, though the exact dat

of its foundation is doubtful. Its first statutes date from 1280.

UNIVERSITY EXTENSION. A movement for bringing university teaching within the reach of a wider public. The scheme originated at Cambridge in 1873, and was adopted by London in 1878 and by Oxford in 1885. Since then the movement has spread throughout Great Britain and Ireland. The organisations arrange for series of lectures to be given at local centres during winter, and for examinations to be held.

UNKNOWN WARRIOR. The unveiling of the War Memorial Cenotaph at Whitehall by King George V. on 11th Nov., 1920 (Armistice Day), was immediately followed by the burial of an Unknown Warrior in Westminster Abbey. The body of a British private soldier, name unknown, had been removed from its first resting-place upon the Western Front and carried to Boulogne, where, on the night of 9th Nov., it lay in state in an improvised *chapelle ardente* of the thirteenth-century château. The following day, after receiving the salute of France from Marshal Foch, it was placed on board the French battleship *Verdun* and escorted across the Channel by representative vessels of the British navy; thence to its tomb among the nation's most illustrious dead. A similar ceremony was performed by several other countries.

UNNA. A town of Germany, in the Prussian province of Westphalia; an important railway junction on the Düsseldorf-Soest line for Hamm and Fröndenberg. It is an ancient place which secured the privileges of a town in 1256 and was a member of the Hanseatic League, and it is now a brisk industrial town with a large beer-brewery, brick-kilns, cement-works, large tramway-car works, iron-foundry, and machine-shops. Pop. 20,000.

UNST. The most northern of the Shetland Islands; length, 10 miles; average breadth, between 3 and 4 miles; pop. (1931), 1341.

UNTERWALDEN. A Swiss canton, bounded on the north by the Vierwaldstätter See (Lake of Lucerne), on the east by mountains which separate it from Uri, on the south by Bern, and on the west by Lucerne; area, 295 sq. miles. It is divided into two valleys or half-cantons, Upper and Lower (Obwalden and Nidwalden), and these districts (politically distinct) each send a representative to the Swiss Council. The chief town of Obwald is Sarnen (pop. 4500), and of Nidwald, Stans (3000). Area: Obwalden, 189 sq. miles; pop. (1930), 19,401; Nidwalden, 106 sq. miles; pop. (1930), 15,055. Both cantons are almost entirely German-speaking Roman Catholic.

UNYORO, or BUNYORO. The most southerly district of the Northern Province of Uganda, bounded in the north by the Victoria Nile, south by the Nkussi River and the River Kafu, and lying east of Lake Albert, nearly the whole of Uganda's share of which is in Bunyoro. The district forms a native kingdom ruled by a *mukama*, who presides over a parliament or *lukiko* at Masindi. Another *lukiko* sits at Hoima.

Physiography. Physically, Bunyoro is a plateau (3000-3800 feet altitude) capped by conical hills (4000-4800 feet), which reach their highest point in Palajoki (4876 feet), north of Hoima. The plateau presents a steep escarpment, the eastern wall of the western rift valley, to Lake Albert, but the walls are not so high or so imposing as those on the western side of the lake.

Climate. The mean annual temperature is about 73° F., and there are four distinct seasons: (1) December to February (dry; 2.5 inches rainfall); (2) March to May (wet; 12 inches rainfall); June to August (dry; 8 inches rainfall); (4) September to November (wet; 11 inches rainfall).

Industries. Cattle-raising is important. In Bunyoro the land is the property of the tribal chiefs and the *mukama*. Native coffee-plantations are extensive; but millet, sweet potatoes, and tobacco are the chief crops. Bunyoro is the chief afforested region of Uganda, containing the Budongo and Bugoma forests. Plumbago (near Hoima), graphite, and gold have been found, and iron ore is worked.

Towns. Masindi is the capital. It lies at the foot of Kigulya Hill (4500 feet), and, laid out in 1912, has developed rapidly, containing an hotel, prison, native hospital, European club, and golf-course. It is connected by road with Butiaba (altitude, 2028 feet, i.e. the same as Lake Albert), the best harbour on Lake Albert, and an outlet for passenger traffic from Uganda to the Belgian Congo, or down the Nile to Khartoum. It is a hot, low-lying mosquito-trap. Kibero, 11 miles south of Butiaba, lies on an alluvial flat fringing the lake, and has salt-works and hot springs. Hoima (3665 feet), 18 miles from Kibero, was the Bunyoro head-quarters between 1900 and 1912. It is the centre of a millet-growing region, and is connected by road with Masindi (34 miles). Fajao (3764 feet) is on the Victoria Nile. Port Masindi stands

at the head of Lake Kioga, where the Victoria Nile emerges, and is on the motor road to Masindi (29 miles). It is the terminal port of the lake-steamer service to Namasagali for the Busoga Railway to Jinja and Lake Victoria.

People. The natives of the district call themselves *Banyoro* and their kingdom *Bunyoro*. The Banyoro are divided into two classes, Hamitic and Bantu, both speaking a Bantu language. The Hamites, the upper class, are tall and well formed nomadic pastoralists, and the Bantus, the lower class, are coarser and smaller-built sedentary agriculturists.

UPANISHADS. Philosophical and religious discourses of the early Brahmans of India. *Upanishad* is derived from the root *sad*, "to sit," with the prefixes *upa* and *ni*, and seems to have originally meant *séance*, attendance (of a disciple before a master), thence mystic doctrine. The oldest Upanishads were Sanskrit prose discourses belonging to the Araṇyakas or "Forest Books" appended to the Brāhmaṇas (see below, under *Vedas*): thus the Aitarēya and Kaushītaki Upanishads belong to the Rigvedic schools so named, the Chhāndōgya and Kēna to the Tāṇdins and Talavakāras of the Sāma-vēda respectively, the Taittirīya to the Taittirīyas of the Black Yajur-vēda, and the Brihad-āraṇyaka to the Vājasanēyins of the White Yajur-vēda. All these are probably not later than 500 B.C.

Then came a number of similar tracts in verse, chief being the Katha or Kāthaka (of the Kāthakas, Black Yajur-vēda), Isāvāsya (of the Vājasanēyins, White Yajur-vēda), Svētāsvatara (Black Yajur-vēda), and Muṇḍaka (Atharva-vēda), which were followed by many others, mostly sectarian, including many of doubtful canonicity and some quite modern concoctions. The number usually admitted in modern editions is 108.

Certain schools of Vedic philosophy had tended towards pantheism, conceiving the whole universe as being fundamentally a unity or single world-spirit; the Upanishads, progressing towards monistic idealism, identified this spirit, which they called *Brahma* (neuter), with the self-consciousness (*ātman*, "self") of the individual thinker. This idea they expressed in formulæ like *aham brahmâsmi*, "I am Brahma"; *tat tvam asi*, "thou art It." The intuitive recognition of this identity by the sage, they maintained, was the salvation of the soul, which thereby won release from the cycle of transmigration (the Upanishads, it should be observed, are the first Indian texts to enunciate distinctly the doctrine of transmigration).

Much of the earlier Upanishadic literature is obscure by reason of the authors' difficulty in finding philosophic expression for their ideas; often, especially in the older parts of the Chhāndōgya, Taittirīya, and Brihad-āraṇyaka, which are notably composite, they use symbols and metaphors derived from the phenomena of nature and the crude Vedic ritualism. Gradually, however, they threw off these fetters, and succeeded in uttering their thoughts in language of remarkable vigour and eloquence, though unsystematically and sometimes inconsequently.

The Upanishads above mentioned, together with a few others, came to be regarded as the scriptural authority for the highest religious-philosophic thought of India, and in order to harmonise them into a consistent system of idealism the Brahma-sūtra, a series of aphorisms wrongly ascribed to Bādarāyaṇa, and was composed, perhaps between A.D. 200 and 500. On these bases were founded most diverse systems, such as the absolute monism of Sankara, the semi-monistic theisms of Rāmānuja, Nimbārka, and others, and the dualistic theism of Madhva.

UPAS. A tree common in the forests of Java and of some of the neighbouring islands, and found also in tropical Africa. It is a species of the genus Antiaris (*A. toxicaria*), nat. ord. Moraceæ. Many exaggerated stories were formerly current concerning the deadly properties of this plant. The truth is, that the upas is a tree which yields a poisonous secretion and nothing more.

UPAVON. Village of Wiltshire. It is on Salisbury Plain, and is known because here is a flying-school of the Royal Air Force. It is north of Amesbury and 10 miles from Devizes.

UPHOLLAND. Urban district of Lancashire. It is 4 miles from Wigan and 201 from London, on the L.M.S. Railway. The chief industry is coal mining. Pop. (1931), 5480.

UPINGTON. A town of Cape Province, South Africa, the metropolis of an agricultural district. It is on the Orange River, 80 miles from the boundary of South-West Africa. Pop. 2508.

UPPER-SENEGAL-NIGER, or **FRENCH SUDAN.** A colony of French West Africa, comprising the former Senegambia and Niger territories, which in 1904 were amalgamated with the military territory of Timbuktu to form one colony; part of Upper Volta was added in 1933; area, 380,557 sq. miles; pop. (1933),

3,568,825. The colony is entirely inland, and is traversed by the Senegal and the Niger Rivers. Native food-grains, ground-nuts, cotton, and sesame are the chief agricultural products; cattle-raising is progressive; and there are many native manufactures (leather, pottery, etc.). Rubber and gum are important items of export. The Thiés-Kayes Railway (*see* SENEGAL) enters the territory to the south-west of Ambidédi and runs to Kayes, whence there is an extension up the Senegal Valley, via Bafoulabé and Kita, to the Niger at Bamako (the capital), thence up the right bank to Koulikoro. French Sudan has been the official name of the colony since Dec., 1920. Part of the territory was detached in 1919 and became the colony of Upper Volta (q.v.).

UPPER VOLTA. A colony of French West Africa, comprising a southern section of French Sudan, from which it was detached in March, 1919; area, 113,185 sq. miles; pop. (1931), 3,000,243. In 1933 part of the colony was included in French Sudan. The colony is entirely inland, lying within the great bend of the Niger, and its production is similar to that of French Sudan. Bouaké, the northern terminus of the Ivory Coast Railway, is connected by motor-car with Ouagadougou (pop. 19,400), the Upper Volta capital.

UPPINGHAM. A town of Rutland, England. It is an agricultural centre, but is especially noted for its grammar-school, which was founded in 1584 by Archdeacon Johnson, and became one of the most important of English public schools under the headmastership (1853-77) of Edward Thring. Pop. (1931), 2453.

UPPSALA, or UPSALA. A maritime län (government) of Sweden, between the län of Västmanland and Stockholm, and with a seaboard on the Gulf of Bothnia. Agriculture flourishes in the plain, but in the north mining (chiefly iron at Dannemora) is the principal industry. The län is served by the railway from Stockholm to Storlien (464¼ miles), via Storvik (for Gefle (q.v.) and Falun). Uppsala, the capital, is on this line, and is connected also with Norrtelje, Enköping, and Gefle direct. Enköping (pop. 5000) is the second town of importance. It is a junction on the Stockholm-Frovi line for Uppsala town, manufactures watches, and has market-gardening interests. Area of län, 2052 sq. miles; pop. (1930), 138,060.

UPPSALA (ancient **ÖSTRA-AROS**). The chief town of the län of Uppsala; served by rail to Gefle (71 miles). It contains the chief Swedish university, founded in 1477; a cathedral originally built between 1260 and 1435, and containing the tombs of Swedish monarchs; and an observatory. Uppsala has been an archiepiscopal see since 1276, when the archbishop removed from Gamla Uppsala, the old capital of the pagan kings of Sweden and the site of the *Kungshogar*, or Tumuli of the Kings, three huge burial-mounds named after the old Scandinavian deities, Odin, Thor, and Freya. The university library contains more than 250,000 volumes and about 7000 MSS., including the *Codex Argenteus*, a Mœso-Gothic translation of the Gospels by Bishop Ulfilas (fourth century), captured at Prague in 1648, and the main source of knowledge of the ancient Gothic language, the progenitor of modern Teutonic tongues. Both cathedral and university suffered greatly in the fire of 1702, as did also the old castle, now partly in ruins, but founded in 1548 by Gustavus Vasa. There is a broadcasting station (453·2 m., 0·15 kw.). Pop. (1932), 30,741.

URÆMIA. A condition due to a toxic state of the blood, arising most probably as a result of the accumulation of substances which are normally excreted by the kidneys. The condition, which usually follows on some form of kidney disease, is an extremely serious one and often fatal. Its outstanding symptoms are headache, laboured and noisy breathing, gastro-intestinal disturbances, convulsions, paralysis, delirium, and coma.

URAL. A river of Russia, which rises in the Ural Mountains, forms part of the boundary between Europe, and Asia, and enters the Caspian after a course of 1400 miles.

URAL-ALTAIC (also called *Turanian*, *Finno-Tataric*, and *Scythian*). A family of languages spoken by peoples inhabiting the "Turanian region" covered by the map given under *Turanian*. The name is a purely artificial compound indicating the two main topographical features and natural boundary-marks of the country in which originated the proto-historic language from which the tongues of the Ural-Altaic system are said to have been derived. Much debatable ground remains to be explored, especially in regard to the genealogical connections of the various units; but the chief divisions and subdivisions of the family may be outlined as follows:

1. **Ugro-Finnic.** *Finnic subgroup.*—Finnish (or (Suomi), spoken in Finland (see *Finns*); Tchudic (including Vepsic and Votic; see *Tchudes*); Karelian, spoken from the White Sea to Lake Ladoga;

Livonian and Crevinian; Estonian (see *Esthonia*); Lapponic (of Lapland, q.v.). See *Ugro-Finns*.

Permian subgroup.—Permian, Sirienian, Votyak (q.v.), all three spoken around the Urals.

Volga-Finnic subgroup.—Mordvinian (of the Middle Volga), Tsheremissian (of the region between Kazan and Nijni-Novgorod).

Ugric subgroup.—Vogul (see *Vogula*), Ostyak, and Magyar (see *Hungary*). See *Ugrians*.

2. **Samoyedic.** See *Samoyeds*.

3. **Tungus,** spoken by the Manchus of Manchuria and the Tungus (q.v.).

4. **Mongolian.**—Mongolian (or Sharra), spoken westward of the Manchu group in the north of the Chinese Empire; Buriat, spoken about Lake Baikal in the Far Eastern Republic; and Kalmuck (Western Mongolian), which extends westwards to the Caspian and to European Russian between the Don and the Lower Volga. See *Kalmucks*.

5. **Turko-Tatario** (Turkic or Tataric).—The group extends from Thrace to the Lena (East Siberia), and includes Yakut (q.v.); Kirghiz (q.v.); Nogair (spoken by the Russian Cossacks in the Crimea and south of the embouchure of the Volga towards the Sea of Azov); Niguric (including Nigur, Jagataic, and Turkman; see *Turcoman*), the dialectic tongues of Turkestan apart from the Khirghiz regions; and Turkish, the tongue of the Osmanlis generally, although the official Turkish language has many exotic elements, mainly Persian and Arabic.

See articles PAN-TURANIANISM; TURKEY (*Ethnology*); TATARS; BURIATS; PHILOLOGY (section *Agglutinative Languages*).

URAL AREA. *See* RUSSIA (table).

URALITE. Pseudomorph of amphibole after pyroxene, occurring on igneous rocks. Also a kind of artificial fire-proof material manufactured from asbestos.

URAL MOUNTAINS. A series of mountains and plateaux stretching nearly north and south between Europe and Asia, from the shores of the Arctic Ocean, for a distance of about 1900 miles; highest summit, 5537 feet. There is but little striking scenery, and the rise is so gradual in some parts that the traveller from Perm to Yekaterinburg, for instance, hardly notices that he has crossed the chain. The Ural Mountains are specially known for the gold, platinum, copper, coal, and iron which they contain.

URALSK. A former government of Russian Central Asia, now an administrative area of Kazakstan. It is mainly a flat sandy plain, marshy in places, and rising in the north to a hilly steppe. The Ural, Sagis, and Emba are the chief rivers. Agriculture is confined to the north, and the main business is cattle-raising. Sverdlovsk is the capital. Area, 653,400 sq. miles; pop. 6,791,875 (largely Moslem-Kirghiz).

URALSK. A town of the Kirghiz Republic, Central Asia, at the confluence of the Tchegan and Ural; served by rail from Saratov (q.v.). It is an up-to-date place with churches, mosques, library, museum, high school, theatre, musical academy, a several newspapers. A brisk trade carried on in cattle and fish. P 35,994.

URANIUM. A metallic element, t atomic weight (238·2) and aton number (92) of which are the highe known. The chief source of t element is the mineral uraninite, pitch-blende (q.v.). Chemically it related to chromium, molybdenu and tungsten. It forms two series salts, uranous and uranic. Sodiu uranate, or uranium yellow, is us as a pigment for painting on glass a porcelain. The chief interest uranium, however, lies in its radi active properties (*see* RADIO-ACTI ITY). In its minerals, it is alway associated with radium, the propo tion in an old mineral being 3 milligrams of radium to 1000 kil grams of uranium. The low-grade o *carnotite*, which occurs abundantly i Colorado, is now worked on a larg scale for radium.

URANUS. In Greek mythology the son of Gæa, the earth, and by he the father of the Titans, Cyclopes and Hecatoncheires. He hated hi children, and confined them in Tar tarus, but on the instigation of Gæa Kronos, the youngest of the Titans overthrew and dethroned him.

URANUS. In astronomy, one of the major planets, and the seventh from the sun, discovered by Sir William Herschel in 1781. It was first called *Georgium Sidus*, in honour of George III., and afterwards *Herschel*, in honour of the discoverer. To the naked eye it appears like a star of the sixth magnitude. Its mean distance from the sun is about 1782 millions of miles, and the length of the year 30,688 days, or about 84 of our years. Its mean diameter is estimated at over 30,000 miles. Its volume exceeds the earth's about 60 times, but as its mean density is only about one-fourth of the earth's, its mass is only about 14·6 times greater. From the shift of lines in the spectrum, a rotation period of 10¾ hours has been deduced. Uranus has four satellites, revolving in a plane which is only 8° from being perpendicular to the ecliptic. Their motions projected on the ecliptic are retrograde, or east to west.

URBAN. The name of eight Popes, of whom the most notable were: **Urban II.,** 1088-99; it was at his instigation that the first Crusade was undertaken, and Jerusalem captured. —**Urban VI.,** 1378-89, so exasperated the cardinals by his reforming zeal that they caused a schism in the Church by electing Clement VII. The

Popes excommunicated each er until Urban died, under cir- ıstances which suggested poison- —**Urban VIII.** (Maffeo Barberini), 3-44, was more of a temporal ıce than a cleric, and was the Pope ɔ condemned Galileo and Jansen. ʃf. L. Pastor, *History of the Popes.*

JRBANA. A city of Ohio, United ıtes, the county seat of Champaign ınty ; served by the Erie and other lways. It is the seat of Urbana iversity, and is a farming centre, ih manufactures of telephones, ɔer, and machine-shop products. unded in 1805, it became a city in 37. Pop. (1930), 7742.

There is another **Urbana** in Illinois, ɔ seat of Illinois State University. p. (1930), 13,060.

URBI'NO (ancient **Urbinum**). A city North Italy, in the province of saro e Urbino. It is the see of an ɔhbishop, and seat of a small uni- rsity (founded 1671) ; the chief ıildings are the ducal palace and the thedral (1801). It was the birth- ace of Raphael, whose house is still own. Pop. 20,500.

UREA, or **CARBAMIDE,** $CO(NH_2)_2$. soluble crystalline substance occur- ıg in urine. It may be regarded as ıe final product of the oxidation of trogenous compounds in the body. rea was the first animal product to ɔ prepared synthetically.

UREDINEÆ. A large, important, ıd very numerous family of Fungi, ɔmprising about 20 genera and 1500 ɔecies, commonly known as rusts. hey are all parasites on higher plants, nd many cause most destructive iseases on cultivated plants, especi- lly the species of Puccinia that attack ereals and the coffee-rust (Hemileia). ee articles on these and on MELAMP- ORA and UROMYCES.

URFA. A town of Turkey, in Asia ſinor. There are several cotton ıanufactories, and trade is carried on ı wheat, wool, hides and skins, and otton. Pop. (1927), 29,098.

Urfa is the modern embodiment of he ancient city of *Edessa*, which, ıuilt by Seleucus Nicator, fell into he hands of the Saracens in A.D. 1184. n Christian times *Edessa* was the ɔrincipal seat of Oriental learning, ınd was famous for its schools of heology, the chief of which was the *Scholia Persica*, carried on especially or the instruction of Christian Per- ians, who were at that time great tudents of Syriac. Under John, Patriarch of Antioch, and Ibas, Bishop of Edessa, the professors took ı leading part in the Nestorian con- roversy, and their Nestorian teach- ngs led to the ultimate downfall of the school, which was demolished in 489 by Zeno, the Roman Emperor, the professors having already been expelled by Martyrus, Bishop of Edessa. Edessa has been mistaken for Ur of the Chaldees (q.v.), but, as the name probably does not go back farther than 150 B.C., this contention is inadmissible.

URGA. City of Mongolia (known as **Hurae**). It is the Mongol holy city and the residence of the lama known as the "Living Buddha." Urga can be roughly divided into three sections, the Kuren, where the lama resides, the Mongol quarter, and the Chinese settlement. The Chinese trade extensively with the Mongols and the Russians in cattle, camels, horses, sheep, and milk.

URI. A canton of Switzerland, bounded by Schwyz, Unterwalden, Valais, Tessin, Grisons, and Glarus ; area, 415 sq. miles. The chief industries are stock-raising and dairying. The inhabitants are mostly German-speaking Roman Catholics. Uri was one of the three original Swiss cantons. The capital is Altorf (Altdorf). Pop. (1930), 22,968.

Uri comprises the valley of the Reuss, which passes into the Plain of Altdorf lying on the Urner See, the eastern arm of the Lake of Lucerne. The Reuss Valley is traversed by the famous St. Gothard Railway, opened in 1887 and forming part of the trunk line from Lucerne to Bellinzona, Lake Maggiore, Lugano, Chiasso, and Rome. From Lucerne it runs by way of the north shore of the Lake of Lucerne, via Küssnacht (pop. 4000), Goldau (for Zürich ; 2000), and Flüelen (1000 ; the port of Altdorf), to Altdorf (3¼ miles from Lucerne) ; then up the Reuss Valley, via Erstfeld, Amsteg, Gurtnellen, and Wassen, to Göschenen (1000 ; for the St. Gothard Tunnel, 9½ miles long). Flüelen and Altdorf are connected by electric tramway, and Altdorf stands at the junction of the Reuss Valley with that of Schächen, along which a line runs, via the Klausen Pass (6400 feet altitude), to Linthal (31 miles).

URIC ACID is found normally in the urine of mammals in small quantities, and is the means by which a small quantity of nitrogen is excreted from the body. In birds and reptiles, however, it is found in much larger quantities. When pure it crystallises in colourless rectangular plates or prisms, but in human urine, when precipitated, it takes on many varied shapes and forms. In excess it tends to form concretions (calculi) found in the kidneys and bladder. *See* CALCULUS.

URIM AND THUMMIM. The sacred lots by which the Israelites ascertained the Divine will. The explanation that the words mean *light* and *perfection* is generally rejected. The lots were two in number, and it was therefore agreed beforehand as to the manner of interpreting the issuing lot. To handle the *urim* and *thummim* was a prerogative of the priests, and in Exod. xxviii., 30, they are described as part of the high-priest's costume. The *urim* and *thummim* have been identified with the jewels of the high-priest's breastplate, and it has been conjectured that they were two stones of different colour. The rabbis supposed that these stones indicated the Divine will by a preternatural luminosity.

URINE. The fluid excreted by the kidneys, passing from them down the ureters to the bladder, where it accumulates, to be discharged from the body through the urethra. The urine, which has a characteristic odour, is normally acid in reaction, but it becomes less acid and may even become alkaline during digestion. The specific gravity in health is between 1010 and 1025, varying inversely with the quantity, while in certain pathological conditions it goes below, and in other conditions above, these limits. Normally about 50 oz. are passed in twenty-four hours, and of that amount 1½ oz. are solids, the chief constituents of normal urine being water, urea, and sodium chloride.

URMIA (Persian *Urumiyeh*). A lake and town of Azerbaijan, Persia. The lake is salt and shallow, and has no outlet; area, 1400 sq. miles. The town lies 12 miles west of the lake. Pop. 20,000.

URMSTON. Urban district of Lancashire. It is 5 miles from the Central Station, Manchester, and 185½ miles from London by the L.M.S. Railway. Its industries are mainly connected with cotton. Pop. (1931), 9284.

UROCYSTIS. A genus of parasitic Fungi, family Ustilaginæ. *U. occulta* destroys shoots of rye, and *U. Cepulæ* attacks and often kills seedling onions.

URODE'LA. An order of amphibian vertebrates in which the larval tail is always retained in the adult, the body being elongated posteriorly into the tail. There are two sections, the *Perennibranchiate Urodela*, in which the gills are retained through life, as in proteus, siren, etc.; and the *Caducibranchiate*, in which the gills disappear at maturity, as in newts and salamanders.

UR OF THE CHALDEES. Ancient Sumerian city. The biblical "Ur of the Chaldees" (Gen. xi. 31, xv. 7), whence Abram set out on his journey into Canaan, is generally identified with it. It was situated on the left bank of the Euphrates, about 153 miles S.E. of Babylon. The modern name of the mound under which it lay is Mugheir. Excavations were begun in the nineteenth century and, after the European War, continuous work was carried on. Since 1922 a joint expedition of the British Museum and the University of Pennsylvania has excavated the mound with remarkable results. The great temple of Nannar, the moon god (c. 2300 B.C.), with its *ziggurat* or stage tower, was unearthed, the discovery of other temples and some private houses followed, and then some royal graves (c. 3200 B.C.) in which were many objects of gold, silver, and semi-precious stones of finest workmanship. In 1929-30 the walls of the city, with a circuit of two and a half miles, were traced.

UROMYCES. A genus of parasitic Fungi, family Uredineæ, distinguished from Puccinia by the one-celled winter-spores (teleutospores). The most important species are *U. Betæ*, beet-rust; *U. appendiculatus*, scarlet-runner rust; *U. Fabæ*, broad-bean rust; and *U. Pisi*, pea- and vetch-rust; the last-named is heterœcious (see *Puccinia*), the cluster-cup stage growing on species of spurge (Euphorbia).

UR'SULA, ST. A virgin martyr, according to the legend, a daughter of a prince in Britain put to death at Cologne by a horde of Huns, some say in A.D. 384, others in 453, together with 11,000 virgins who accompanied her. According to an earlier and more probable reading, the number of her companions was only eleven.

UR'SULINES, or **NUNS OF ST. URSULA.** A sisterhood founded by St. Angela Merici, at Brescia, in 1537. The Canadian Ursulines date from 1639; the Irish from 1771. The Ursulines have several educational establishments in Ireland, England, and Scotland.

URTICA'CEÆ. A natural order of dicotyledonous (apetalous) trees, herbs, and shrubs. In an extended sense the order includes the Ulmeæ, or elm family; the Moraceæ, or mulberry family; and the Cannabineæ, or hemp family. But the order is more frequently confined to the Urticeæ, or nettle family; typical genus, Urtica (*see* NETTLE). The juice of the restricted order is watery, not milky; the wood in the arbore-

is or shrubby species, which are all opical, is soft and light. The fibre the bark of some is valuable.

U'RUBU. The native name of an merican vulture, the *Catharista ratus* (black vulture or zopilote), ery nearly allied to the turkey-uzzard. This voracious bird is com-ion in the Southern States of North merica, acting as a scavenger.

URUGUAY. The smallest republic f South America, known officially as he *República Oriental del Uruguay.* t is divided into nineteen depart-ients as follows :

Departments	Area,[1] sq. Miles	Population (1932)
Artigas	4,394	49,177
Canelones	1,834	179,070
Cerro-Largo ..	5,763	85,030
Colonia	2,193	113,456
Durazno	5,525	82,675
Flores	1,744	31,249
Florida	4,673	93,907
Lavalleja	4,819	103,228
Maldonado	1,587	58,745
Montevideo ..	256	489,685
Paysandu	5,115	72,257
Rio Negro	3,269	30,719
Rivera	3,793	65,475
Rocha	4,280	61,731
Salto	4,865	87,127
San José	2,688	88,306
Soriano	3,561	79,631
Tacuarembo ..	8,112	91,397
Treinta y Tres ..	3,682	59,539
Total	72,153	1,922,404

[1] Area according to *The Statesman's Year Book.*

Towns. Montevideo is the republican capital ; other towns are Paysandú, Minas, Maldonado, Rivera, Rocha, and Fray Bentos, articles on which should be referred to. Other departmental capitals (besides those mentioned) are ; Artigas, capital of Artigas, Uruguay's most northern department ; Canelones, or Guadeloupe, capital of Canelones, the chief Uruguayan stock-raising department ; Melo, capital of Cerro-Largo ; Colonia, seaport-capital of Colonia ; Durazno, or San Pedro del Durazno, capital of Durazno ; Trinidad, capital of Flores ; and Florida, capital of Florida. Mercedes, capital of Soriano, is the chief port on the Rio Negro.

Physical. Uruguay comprises two distinct regions, plain and plateau. The latter forms the southern projection of the Brazilian Highlands, and is divided roughly into an eastern division, the Cuchilla Grande, and the more northerly Cuchilla del Haedo, both being under 1500 feet altitude. On the eastern frontier (to the Brazilian department of Rio-Grande-do-Sul) is the Lago Mirim, to which the eastern versant of the Cuchilla Grande is drained, mainly by rivers of the Cebollati system.

The hydrographic system of Uruguay is simple, for, excepting only the small area of coastal drainage, the rest of the republic belongs to the drainage basin of the Uruguay River, which forms the whole of the western frontier (about 235 miles). Nearly the whole of the waters of the central region of Uruguay are carried to this stream of the Rio Negro with the Yi and other affluents, whose drainage basin is thus equal to one-half (approximately) of the total area of the republic. In addition to the Uruguay river-frontage, there is a seaboard of 120 miles on the Atlantic and of 235 miles on the La Plata estuary.

Climate. Rainfall is about 43 inches per annum, well distributed over the whole year ; and the mean annual temperature is 62° F. (January, 73° ; July, 51·8°). May is the rainiest month in Montevideo. Generally speaking, the climate is an exceptionally healthy one, and is reflected in the mentality and physique of the people.

Production and Industry. The live-stock industry dwarfs all others in Uruguay, and the production of meat, hides, skins, and wool is highly specialised. With the meat trade such firms as Liebig's, Armour, and Swift are mainly concerned ; the " kill " in 1930 amounted to 1,285,246 cattle, and 2,725,989 sheep. About 60 per cent of the area is used for pastoral purposes, and over 90 per cent of the exports are connected directly with the meat-producing industry. The wool-clip is important. Only about 7 per cent of the area is devoted to agriculture, which is confined mainly to the departments of Canelones, Colonia, Florida, Minas, and San José. Wheat, corn, and oats are the chief crops. Wine is produced in Canelones, Colonia, Paysandú, and other departments. Miscellaneous industries include the brewing of beer, match-making, and manufactures of leather and leather goods, furniture, and household commodities in general. Uruguay's best customers are the United Kingdom, Germany, France, Argentina, Italy, the United States, Brazil, and Spain, and with these countries the bulk of her trade is carried on. Imports are confined chiefly to manufactured goods, such as sugar, coffee, rice, olive-oil, kerosene, wood alcohol, cotton stuffs for clothing, cotton yarns and thread, clothing of all kinds, agricultural machinery, and paper.

Communications. The republican mercantile marine is insignificant, and maritime communications are main-

tained largely by foreign shipping. There are 1729 miles of railways, of which 205 miles are State-owned. The chief line is that operated by the Central Uruguay Railway, and known as the Combined System (980 miles), the trunk line of which serves the central departments and connects Montevideo with Rivera and Santa Anna do Livramento (Brazil). The Midland (320 miles) centres on Paysandú, and the North-Western (113 miles) on the river-port of Salto, which it connects with Uruguayana (Brazil) and with the Northern Railway (72 miles) at Isla Cabello. Artigas is the terminus of the latter system, which serves a thinly peopled stock-raising region. Operated by the State are the lines Olmos-Maldonado (78 miles), Montevideo-Santiago Vasquez (12 miles), Durazno-Trinidad (29 miles), and Rocha-La Paloma (20 miles). The standard gauge is 4 feet 8½ inches. *See* RIO-GRANDE-DO-SUL. Air service connects Montevideo with Venezuela, Buenos Aires, and the United States.

Religion and Education. The predominant religion is the Roman Catholic, but religious liberty is guaranteed, and Church and State are distinct. Primary education is compulsory, and there is a university at Montevideo, besides polytechnics throughout the republic, and a military college.

Defence. There is a small voluntary standing army, which is supported by a conscripted National Guard divided into three "bans" of varying age-limits. The total war strength of both corps amounts approximately to 150,000 men. A "fleet" of a torpedo gun-boat and a few smaller vessels is maintained.

Currency. There is a theoretical gold standard, but with the exception of a few gold coins issued in 1930 to commemorate the centenary of the Constitution, only foreign gold is in circulation. The theoretical gold coin is the *peso* of 100 *centisimos*. Paper notes are circulated. Silver coins are the 50 *centisimos* and 20 *centisimos* pieces. Nickel coins worth 5, 2, and 1 *centisimos* are minted. Weights and measures are on the metric system.

Government. Executive power is in the hands of a President and Administrative Council. The President is elected by popular vote for a term of four years, and may seek re-election eight years after the expiry of his term of office. The Council is elected by popular vote. Legislative power is vested in a bicameral Legislature comprising a Senate (appointed by an Electoral College of the people's own choosing, one Senator from each department sitting for six years) and a House or Chamber of Repr sentatives (elected by popular vo for three years; one member 12,000 qualified voters). A Cabine with portfolios of Foreign Affair War, Marine, and Interior, is a pointed by the President; and to the Council sends ministers of Edu cation, Finance, Industry, and Publ Works.

History. The early history of Uru guay is that of Montevideo, whic was founded by Spaniards in 172 more as an outpost of Buenos Air than anything else, and ultimatel (1778) became a free port. The ex pulsion of the Spaniards, in 181 was followed by the occupation o the La Plata zone by Portugues troops and the annexation of th region to Brazil (1824). In 1827 however, the imperialist régime wa overthrown, and the independence o Uruguay was recognised by Argentin and Brazil on 25th Aug., 1828, mainl by the intervention of Great Britain.

Montevideo suffered a nine-years siege by Argentinian troops betwee 1843 and 1852. Anarchy reigned fo many years, and revolution followed revolution with such rapidity that public welfare ceased to be attended to, and power was in the hands of the strongest, which by no means implies that it was also the monopoly of the fittest. After an appalling period of bloodshed and corruption Juan Cuestas became President, and laid the foundations of political stability. He was succeeded in 1907 by Claudio Williman, who further improved the government and the public services, and gave place in 1911 to José Battle y Ordónez, who completed the work of organising the public departments, etc., and the suppression of revolutionary movements. Feliciano Vieira was the War President. He was elected in 1915 and was of pro-Allied sympathies. Uruguay declared war on Germany on 6th Oct., 1917. Vieira was succeeded in the presidency by Baltasar Brum. Uruguay became a member of the Council of the League of Nations in 1922. Dr. Gabriel Terra became President in 1931.

BIBLIOGRAPHY: P. F. Martin, *Through Five Republics*; *The Statesman's Year Book* (article *Uruguay*); A. H. Keane, *Uruguay* (in *Central and South America* volume of Stanford's *Compendium of Geography*); H. J. Gordon Ross, *Argentina and Uruguay*; W. H. Koebel, *Uruguay*; *Reports* on economic and financial conditions in Uruguay (issued by H.M. Stationery Office).

URUGUAY, RIO. A river of South America, rising in Southern Brazil,

nd flowing southwards to form, with he Paraná, the Rio de la Plata (q.v.). t forms the territorial boundary be- ween Argentina and Brazil, and etween Argentina and Uruguay. ee PAYSANDU.

URUGUAYANA. A city and river- ort of Rio-Grande-do-Sul, Brazil, n Uruguay River; served by rail o Montevideo, via Quarahim (fron- ier) and Paysandú (q.v.). Pop. 21,000.

URUMCHI, or TIHWAFU. Ad- ministrative centre and capital of Sinkiang, Chinese Turkistan. Pop. 30,000.

URUNDI AND RUANDA. Two provinces of former German East Africa. After the conquest of this colony, and at the end of the Euro- pean War, it was assigned in its entirety to Britain as mandatory. The Imperial Government, however, handed over most of Ruanda and Urundi to the Belgian Congo. Area about 20,000 sq. miles.

URUS. A kind of large ox which ran wild in Gaul at the period of the Roman invasion, as described by Cæsar, perhaps the wild ox such as still exists at Chillingham in Nor- thumberland and Hamilton in Lanark- shire, or else the aurochs.

USEDOM. A Prussian island in the Baltic, on the Pomeranian coast; area, 150 sq. miles. Agriculture and fishing are the chief industries. Swinemünde (the district capital) and Usedom are the chief towns, and both are served by a branch of the Stettin-Stralsund Railway from Du- cherow.

The shores of Usedom are studded with villages, which are all linked up by coastal railway with Swinemünde, and which are largely frequented for sea-bathing. Among them are: Ahlbeck (pop. 4000), Heringsdorf (1000; pier; over 15,000 bathers come here yearly), Uckeritz, Koserow (700), and Zinnowitz (2000; about 10,000 bathers yearly).

USHAK. A town of Turkey, in the vilayet of Brusa, on an affluent of the Menderes; served by the Central Railway to Konieh and Smyrna (Izmir). Valonia and cereals are ex- ported, but the town is best known by its carpets. Pop. 15,000.

USHANT (ụ-shant'; Fr. *Ouess- ant*). An island of France, 15 miles off the west coast of the department of Finistère, to which it belongs; area, 6 sq. miles. Fishing and the rearing of sheep are the principal occupations. Pop. 2568.

USHAW. Village of Durham. It is 4 miles from Durham, and has a college for training men for the Roman Catholic priesthood. It was founded in 1804 for the students who had been obliged to leave Douai, and is dedicated to St. Cuthbert.

USHER, or USSHER, James. Irish prelate, born at Dublin 1580, died 1656. He took orders in 1601; in 1607 received the professorship of divinity at Trinity College, Dublin, and the office of chancellor of St. Patrick's; in 1620 the bishopric of Meath; in 1623 a place in the Irish Privy Council; and in 1624 the primacy of all Ireland. He was a man of great erudition, his chief works being the *Annales Veteris et Novi Testamenti*, which forms the basis of the received Biblical chro- nology; and *Britannicarum Ecclesi- arum Antiquitates*.

USK. A river of South Wales and Monmouthshire, rising on Carmar- then Van, and flowing past Brecon, Abergavenny, Usk, Caerleon, and Newport to the Bristol Channel, which it joins 4 miles south of Newport after a course of 69 miles; drainage basin, 550 sq. miles. Between New- port and the embouchure the river is navigable, and in the higher reaches it is noted for salmon and trout.

USK. A town of Monmouthshire, England, on the Usk. It is a place of ancient foundation, representing the Brythonic *Brynbega* and the Roman *Bullæum*. There is a grammar school, and ruins of a castle founded by the Clares in the early thirteenth century, and said to be the birth- place of Edward IV. and Richard III. The church of St. Mary repre- sents a Benedictine nunnery also founded by the Clares. Pop. (1931), 1315.

USKUB, or SKOPLYE (the former being the Turkish and the latter the Slav form). A town of Yugoslavia, at the head of navigation on the Vardar; an important strategic rail and road centre, 150 miles from Salonika, on the Belgrade-Nish-Salonika Railway, which follows the ancient *Egmontian Way*, the north and south route be- tween the Ægean and the Danube along the Morava and Vardar Valleys. A branch line runs to Mitrovitza (75 miles).

Skoplye is an important trading and distributing centre whose com- mercial wealth is of recent growth. There is an opium market; and there are cotton-factories, tanneries, and dye-works. Leather, metal goods, grain, and plums are exported; antimony is found in the vicinity, and the town is also a centre of Yugo- slavian cereal cropping (maize, barley,

and oats) and sericulture. Pop. (1931), 64,807.

History. Skoplye is the ancient *Scupi*, and represents *Justiniana Prima*, the city built by Justinian after the destruction of Scupi by earthquake (A.D. 518). The ruins of Scupi may still be seen. In the fourteenth century the town fell to the Osmanlis, from whom it was retaken by the Serbians in 1912, and lost to the Bulgarians in 1915 (European War), passing eventually to aggrandised Serbia.

U.S.S.R. *See* RUSSIA.

USSURI, or **USURI.** A river of Eastern Asia, a right-bank tributary of the Amur, forming with the Sungacha (rising in Khanka (Hanka) Lake) the boundary between the Maritime Province of the Far Eastern Republic and the Chinese province of Manchuria. It is navigable. The railway from Vladivostok to Khabarovsk follows the Ussuri Valley.

USTILAGINEÆ, or **SMUTS.** An interesting group of parasitic Fungi, usually classed as a low type of Basidiomycetes, but possibly more nearly akin to the Chytridineæ. They attack various parts of the host, causing characteristic malformations, and ultimately filling the invaded organs with sooty masses of minute spores produced in prodigious quantities. The leading genera are Ustilago, the different species of which are the cause of smutted corn in cereal crops; Tilletia, one species of which (*T. tritici* or *T. caries*) produces the "bunt" or "stinking smut" of wheat; and Urocystis.

USTI NAD LABEM. *See* AUSSIG.

USTRON. A town and health-resort of South-Western Poland, on the Weichsel; served by rail to Bielsco (Bielitz). It has a bathing institute with mud-baths, an iron-works, and machine-shops. Pop. 6000.

USURY (Lat. *usus*, use). Originally the payment of interest as consideration for the use of money; now the taking of iniquitous or illegal interest. By the Mosaic Law usury was forbidden among the Hebrews, though permitted between a Hebrew and a stranger; and the Canon Law, following the precept "Lend, hoping for nothing again," prohibited it entirely. Gradually, however, many devices were adopted for overcoming the strict letter of the law, and by the sixteenth century the taking of interest had come to be generally recognised as fair and proper.

From that period a series of statutes came into existence for the purpose of regulating the rates to be charged. For long the legal rate w 5 per cent, and no higher was e forceable; but in 1854 the usu laws were swept away and borrow and lender, generally speaking, le free to agree upon any rate of i terest. Pawnbrokers' charges, hov ever, are still strictly regulated b law, and the courts have power t review any transaction with a mone lender in which an excessive rate interest has been charged. *S* MONEYLENDERS ACT; PAWNBROKER

USWORTH. District of Durhan It is 7 miles from Newcastle-on-Tyn and is a coal-mining centre. There i a station on the L.N.E. Railway. Poi 7985.

UTAH. A State in the Mountai division of the United States. It i mountainous (general elevation, 500 feet), and is divided into two region by the afforested Wasatch Mountains an extension of which, the Uint Mountains (Gilbert Peak, 13,422 fee altitude), abounds the State in th north. The west belongs to the grea basin, and is largely desert, a feature being the saline lakes (Great Salt Sevier, etc.). Utah Lake is fresh. In the submontane zone conditions are more favourable. The east is a rugged mountain region which, with the south and part of the south-east of the State, is drained to streams of the Colorado river-system.

Climate. The mean annual temperature at Salt Lake City (the capital) is 51·5° F. (January, 29·0°; July, 75·0°), and the rainfall 16 inches, March, April, and May being the rainiest months.

Towns, etc. Towns include Ogden (q.v.), Provo, and Logan. There are 2475 miles of railway (about 279 being electric).

Products. Utah is largely agricultural, producing wheat and oats (the chief cereals), maize, rye, barley, potatoes, and hay. Stock-raising is progressive, and wool is largely produced. Mineral products are important, and include argentiferous lead, zinc, copper, iron ore (hematite and magnetite), sulphur, petroleum, coal, salt, and precious and semi-precious stones.

Social Conditions. In religion the State is 91 per cent Mormon. Of the people in 1930, 8·6 per cent were foreign-born, and of this number 24·8 per cent were English, the rest being Danes, Swedes, German, Italian, and Greek. Only about 0·2 per cent were coloured. Education is free and compulsory between the ages of eight and sixteen years, and a measure of secondary instruction up to eighteen years in enforced. The University of Utah (Salt Lake City), Agricultural

College of Utah (Logan), Brigham Young (Mormon) University (Provo), and Mormon College (Logan) are the chief seats of higher education. Area, 84,990 sq. miles (2800 being water); pop. (1931), 507,847 (2869 being Indians, for whom there were 531 sq. miles of reservations).

Constitution and History. Settled by Mormons in 1847, Utah became a Territory in 1850 and a State of the Union in 1896. There is a bicameral Legislature, comprising Senate (20 members, elected for four years) and House of Representatives (55 members, elected for two years). Two Senators and two Representatives are sent to Congress.

UTAH LAKE. A freshwater lake of Utah, United States. It is 25 miles in length north to south, with an extreme width of 13 miles. Its waters are drained into Great Salt Lake by means of the River Jordan.

ÜTERSEN. A town of Holstein, Prussia, on the navigable Pinnau; the terminus of a light railway to Tornesch. There are many industries, such as hat-making, tanning, brewing, and the manufacture of leathers, machinery, cloth, and cigars. A considerable shipping trade centres in Utersen. Pop. 9000.

U'TERUS, or WOMB. An organ of females, situated between the bladder and rectum, in which the embryo is contained until it arrives at maturity, when it is finally born or expelled. In the virgin female it is somewhat pear-shaped, and measures about 3 inches long, 2 inches broad, 1 inch thick, and weighs about 1½ oz. It is divided into a *fundus* or base, a *body*, and a *cervix* or neck. It opens into the vagina by a transverse aperture (*os uteri*). The organ is retained in its place by certain ligaments derived from the peritoneum. Its internal cavity is small, and at each superior angle at the fundus a *Fallopian* tube or oviduct enters. These tubes convey the ova or eggs from the *ovary* (q.v.) to the uterus.

In structure the uterus is composed of an outer serous coat, a middle muscular coat, and an inner mucous lining. The arteries of the uterus are derived from the internal iliac and the aorta; the veins are large, and are called *sinuses* in the impregnated state. The nerves spring from the inferior hypogastric and spermatic plexuses, and from the third and fourth sacral nerves. The womb is liable to many diseases, of which the most frequent and important are inflammatory affections and tumours. It is also liable to become displaced in various ways, from laxity of its ligaments and other causes (*see* PROLAPSUS UTERI).

UTICA. An ancient city of Tunisia, North Africa, of which only vestiges now remain. According to Aristotle, it was founded in 1100 B.C. (i.e. 287 years before Carthage) as a Tyrian (Phœnician) colony, and stood at the embouchure of the *Bagradas* in the Bay of Carthage (Gulf of Tunis). It had artificial harbour-works and extensive fortifications; but the former have now been silted up and almost covered by deltaic deposits of the *Bagradas* (modern Majerda). Utica was the centre of a great corn-raising region with a large export trade (especially with Rome), and mineral-veins in the adjacent hills were extensively worked.

Although the ally of Carthage from early times, Utica made a separate peace with Rome during the third Punic War, and received a grant of Carthaginian lands, becoming, later, the capital of the Roman province of Africa. It was the scene of the death of the younger Cato. Falling to the Vandals under Genseric (A.D. 439), it was recovered by the Byzantines, and later conquered by the Mahommedans, who eventually destroyed it. Valuable marbles and columns were transported to Tunis, and were embodied in the fabric of the great mosque there. *See* CARTHAGE (map and article).

UTICA. A city of New York, United States, the county seat of Oneida county, on the Mohawk River; served by the New York Central, Delaware, Lackawanna & Western, the West Shore, and other railways, and by the Erie Canal. It is an industrial city, and is the export centre for cheese and other dairy produce of a large agricultural region. Manufactures include hosiery, woollens and clothing, machinery, and metal goods. Utica was founded as Fort Schuyler, incorporated in 1797, and became a city in 1832. Pop. (1930), 101,740.

UTIEL. A town of Spain, in the province of Valencia, on the Magro; the terminus of a railway (55 miles) from Valencia. Manufactures include wines, soaps, leathers, silks, and linen. Pop. 12,000.

UTILITARIANISM. A body of doctrine which was worked into a complete system of social philosophy by Jeremy Bentham (1748-1832). Its basis lay in the belief that every individual is governed in his actions by the desire to secure pleasure and to avoid pain. This "hedonistic" standpoint was universalised by Ben-

tham and made into a general ethical and social code, in accordance with which all political and social institutions should be judged by a single standard—the extent to which they contribute to or hinder the greatest happiness of the greatest number. At the same time it was assumed that this greatest happiness could in fact be assured by such a state of political and economic freedom as left each individual free to pursue his own happiness. Thus utilitarianism was in complete harmony with the general point of view expressed, independently of Bentham, by Adam Smith in his *Wealth of Nations*.

This doctrine played a very important part in the first half of the nineteenth century, and influenced legislation and political institutions in many directions, reforms long overdue in civil and criminal jurisprudence being carried out under its influence. The "Philosophic Radicals" who led the agitation in favour of the repeal of the Corn Laws appealed for support to the principles of utilitarianism. Ricardo, James Mill and his son John Stuart Mill, and other economists were profoundly imbued with the teachings of Bentham, which expressed admirably that spirit of wholehearted and uncompromising individualism so characteristic of this period.

It is now generally recognised, however, that utilitarianism, both as a philosophical and an ethical system, is open to serious criticism. The phrase "the greatest good of the greatest number" is so vague and equivocal as to be practically devoid of all value if it is analysed, while the deduction that this will be brought about by the unfettered pursuit by each individual of his own happiness is indefensible. A considerable part of the legislation of the second half of the nineteenth century has been devoted to restraining people from injuring the general interest in their efforts to benefit themselves. — BIBLIOGRAPHY: E. Albee, *History of English Utilitarianism*; Leslie Stephen, *English Utilitarians*.

UTOPIA (Gr. *ou*, no, *topos*, place). The name of a political romance written by Sir Thomas More in 1516, and translated into English by Ralph Robinson in 1551, and by Bishop Burnet in 1683. The author applied the name of Utopia to an imaginary island, which he represents as discovered by a supposed companion of Amerigo Vespucci, and where the inhabitants were supposed to live under the most happy conditions, based on the community of goods.

The terms Utopia and Utopian are now applied to any imaginary state where things are perfect, and to every conception of a moral or social order which is absolutely impracticable, like Aristophanes' Nephelococcugia (Cloud-cuckoo town). Among other works similar to More's *Utopia* are: Plato's *Republic*, Bacon's *New Atlantis* (1624-9), Campanella's *City of the Sun* (1623), James Harrington's *Oceana* (1656), Cabet's *Voyage en Icarie* (1840), William Morris's *News from Nowhere* (1890), and Hertzka's *Freiland* (1891).

UTRECHT. A province of the Netherlands, the smallest in the kingdom; area, 526 sq. miles; pop. (1931), 415,545. It is mainly flat, and is traversed by the ridge or plateau of gravel which forms the Rhine-Elm watershed. The province drains to the Elm, which is entirely within it, and to the Rhine, which does not enter it at all. Utrecht is the capital; Amersfoort (pop. 1932, 39,705), Bunschoten (a Zuider Zee fishing-town), Doorn, Amerongen, and Zeist are other notable places. Agriculture, dairying (including the making of Gouda cheese), and fruit-growing are the chief industries.

UTRECHT. A city of the Netherlands, capital of the province of Utrecht, on the Crooked Rhine at its bifurcation into Vecht and Old Rhine; an important junction on the main lines from Hoek van Holland to Vienna, Berlin, etc., for Boxtel (38 miles, via s'Hertogenbosch for Zwaluwe), Zwolle (for Groningen), Baarn, The Hague, Emmerich, and Amsterdam. It is actually the nodal point upon which the Dutch railway system is built up. An extensive trade in grain and cattle, and in Utrecht velvet, carpets, floorcloth, cottons, linens, chemicals, etc., is carried on. Utrecht is the oldest town of Holland, and was called by the Romans *Trajectum ad Rhenum*, that is, "Ford of the Rhine," and later *Ultratrajectum*. Pop. (1932), 156,194.

UTRECHT, PEACE OF. A series of separate treaties agreed upon at Utrecht by the Powers which had been engaged in the War of the Spanish Succession. On 11th of April, 1713, the States-General, Prussia, Portugal, and Savoy, signed separate treaties with France. The emperor refused to accede to the peace, and his differences with France were subsequently adjusted by the Treaties of Rastadt and Baden in 1714.

By the treaty with England, France, among other things, recognised the Hanoverian succession, engaged never to unite the crowns of

France and Spain, and ceded to Britain Nova Scotia, Newfoundland, St. Kitt's, and Hudson Bay and Straits. Gibraltar and Minorca were also ceded on behalf of Spain. Holland retained the Spanish Netherlands until a barrier treaty was arranged with Austria. Louis XIV. recognised the title of the King of Prussia, who received a part of Spanish Gelderland, and the sovereignty of Neuchâtel in Switzerland, while renouncing the principality of Orange. Savoy and Nice were restored to the Duke of Savoy, who was recognised as presumptive heir to the Spanish monarchy, and received the title of king. Philip V. was not recognised till the conclusion of these treaties, but France treated for Spain, and formal treaties corresponding with those with France were afterwards signed with that Power.

UTRERA. A town of Spain, in the province of Sevilla; served by the railway Sevilla-Cadiz (95 miles), and the line (69 miles) from Utrera to La Roda, a junction on the line Malaga-Cordoba (120 miles). Utrera lies on a fertile plain, and has oil and wine manufactures, and animals are bred locally for bull-fighting purposes. Pop. 18,000.

UTTOXETER. An ancient town of Staffordshire, England. It was the Saxon *Uttoceaster*, which passed to one de Ferrers at the Norman Conquest, and ultimately became the property of John of Gaunt and, later, of the Talbots. About 1205 one of the Ferrers raised Uttoxeter to borough rank. Agricultural implements, nails, and beer are among its manufactures. Pop. (1931), 5907.

UXBRIDGE. A town of Middlesex, England, on the Colne, 15 miles west of London. It has an iron-foundry, breweries, brick-kilns, etc. The Royal Air Force has a training centre here. Uxbridge was anciently known as Waxbreuge, Woxebrugge, and Oxburge, i.e. Great Bridge, and is said to have been founded by Alfred. It was the scene of negotiations between Charles I. and Parliament in 1645. Pop. (1931), 31,866.

UXMAL. A ruined Maya city in the Mexican state of Yucatan, near Ticul (q.v.). There are several buildings in a fine state of preservation, and noted for their relief work and general ornamentation. All the ruins date from the thirteenth or fourteenth centuries. *See* MAYAS.—Cf. Charnay, *Les anciennes villes du Nouveau Monde.*

UZBEK. The Transoxiana group of the Turkish division of the Turanian peoples. The group inhabits part of Turkestan north of the Turkmens country, and, while it overflows into Northern Afghanistan, its main distribution is confined to the region lying astride the Oxus and south of the Aral Sea. All the Uzbeks, about 800,000 in number, are classed as Central Asian Turks. Nearly 500,000 of them are found in Samarkand and 200,000 in Northern Afghanistan. Khiva is over 60 per cent, and Bukhāra 30 per cent, Uzbek, and the group has an overwhelming majority in Samarkand and in parts of Ferghana and Sir Darya. They are Moslems. The universal language is Jagatai, and there is a popular literature.

UZBEK REPUBLIC. A Soviet Socialist Republic of the U.S.S.R. (*see* RUSSIA) in Russian Turkestan. It was formed in 1924 (for constituent parts *see* TURKESTAN REPUBLIC). For area and population *see* RUSSIA (table).

V

V. The twenty-second letter of the English alphabet, a labial, formed by the junction of the upper teeth with the lower lip, and a gentle expiration. It resembles the letter *f*, but is *sonant* and not, like it, *surd* or *hard*.

VAAL RIVER. A river of South Africa. It rises in the Drakensberg, separates the Transvaal and Orange Free State, and enters the Orange River, of which it is the chief tributary ; length, 500 miles.

VACCINATION. A method of inoculating man with vaccinia or cowpox to protect against smallpox. Jenner in 1796 introduced vaccination into England, but prior to that time inoculation of smallpox itself had been practised. Early in the nineteenth century, however, vaccination rapidly replaced the older inoculation, and by the first Vaccination Act (1840) it was provided free by the State. Exemption on conscientious grounds was granted in 1898, and in 1907 it was made easier to obtain exemption. Revaccination is not compulsory in this country.

Vaccination may be performed on any part of the skin, but the usual site is the left arm. The skin is suitably prepared and then scraped, and the lymph rubbed into the scarified areas. A person should not be regarded as insusceptible to vaccinia till the process has been repeated unsuccessfully at least three times.

The outstanding arguments in favour of vaccination are that prior to its general introduction in infancy smallpox was pre-eminently a disease of childhood, like measles to-day, and it is estimated that in pre-vaccination days one-twelfth of all children died from smallpox. Now the great majority of patients in a smallpox hospital are adults. Further, in those children who have been vaccinated and yet take smallpox, it is of a much milder character than in the unvaccinated, while the immunity of the recently vaccinated or revaccinated in an epidemic is striking. Opponents of vaccination have urged that the decline in smallpox is due to improved sanitation and not to the protection of vaccination.

VACHA. A town of Thurin Germany, on the Werra ; the ju tion of Salzungen, on the Gerstun Mansbach Railway. Paper, agri tural machinery, etc., are m Pop. 5000.

VACHELL, Horace Annesley. E lish novelist and playwright. He born 30th Oct., 1861, and educa at Harrow and the Royal Milit College, Sandhurst. He receive commission in the Rifle Brigade 1883, but soon abandoned the ar for a literary career. In the long of his novels and plays, *Quinney's* dramatised novel, set in an antic shop, is probably the best known a most popular.

VACUUM CLEANER. An app ance for the extraction of dust fr within the texture of such fabrics carpets and upholstery as well as the removal of surface material. T partial vacuum used is obtained the operation of bellows actuat from the wheels during running by means of a small electric motor.

VACUUM TUBE. A glass vess fitted with two electrodes and pr vided with means of connection to high-vacuum pump (*see* AIR-PUMP When an active induction coil connected to the electrodes of a lon vacuum tube containing air at o dinary pressure, beautiful optic phenomena are observed as th vacuum is being established. N discharge takes place till the pressur is diminished to about a fifth of a atmosphere. The luminosity of th tube is at a maximum at a pressur of about 1 cm. of mercury. O further reduction of the pressure, th luminious column, known as th positive column, retreats from th cathode and breaks into layers c striæ ; a dark space—the Farada dark space—becomes evident be tween the positive column and th bluish light near the cathode, calle the negative glow ; and a dark laye known as the Crookes dark spac develops round the cathode ; luminous layer surrounds the cathod itself. The pressure is now about mm. of mercury. As the pressure further diminished, the positiv column disappears, the negative glo

the tube near the cathode, and Crookes dark space expands to-ds the walls of the tube, which in to glow with a pale-green fluo-cence. The air pressure is about h mm. On further increasing the uum, the Crookes dark space ex-nds and the fluorescence of the ss tube increases in brilliancy; the ssure has now been reduced to out $\frac{1}{1000}$th mm. The conductivity the gas has now begun to decrease, d by reducing the pressure to out $\frac{1}{20000}$th mm., the vacuum be-mes non-conducting, and the dis-arge ceases.

The discharge through the tube kes place by a process of convec-on. Crookes showed that in a tube the fluorescent stage (Crookes' be) the discharge was accompanied r a stream of "radiant matter" om the cathode, the particle of hich is now known as an *electron* (q.v.). Besides the stream of electrons, here is also a stream of positively harged gaseous particles from the node. These move with much maller speed than the electrons, but re also subject to deflection by agnetic and electrostatic fields; hey have been called canal rays nd positive rays. The electric dis-harge appears to depend on the ollisions of positive ions with the athode.

Commercially the vacuum tube is low largely used for illuminated signs nd advertisements, the colours being aried by the introduction of different ases (e.g. neon) at low pressure.

VADUZ. Capital of Liechtenstein. Pop. 1715.

VÁG-ÚJHELY (Ger. *Waag-Neustadtl*; Slovak. *Novomesto*). A town of Czechoslovakia, on the Vág (Waag); served by the Bratislava-Trencsin railway. There are grain, wool, and leather markets. Pop. 6000.

VALAIS (vå-lā; Ger. *Wallis*). A southern canton of Switzerland, abutting on France and Italy; area, 2020 sq. miles. It is surrounded on all sides by sections of the Alps, with ridges 13,000 to 15,000 feet high, and magnificent glaciers. The Rhône traverses the whole length of the canton, forming the largest valley in Switzerland. The mountain slopes are afforested. Rich pastures support numerous cattle, the chief source of subsistence of the inhabitants; and in the lower valley of the Rhône there is much arable land, the finer fruits are grown, and silk-worms reared. Wine is produced. In the Upper Valais German, in the Lower French is spoken. The canton was admitted into the Confederation in 1553. Sion is the capital. Pop. (1930), 136,394.

VALDAI HILLS or **PLATEAU.** An elevated region of Western Russia, in the former government of Novgorod. They form part of the Plateau of Central Russia.

VALDEPEÑAS (vål-de-pen'yås). A town of Spain, in the province of Ciudad-Real; a junction for Puertollano on the Madrid-Sevilla Railway. It is celebrated for red wine, and has iron-springs and bathing establishments. Pop. 25,000.—Valdepeñas (de Jaen) is another town in Jaen province. Pop. 5000.

VAL DE TRAVERS (vål dė trå-vār). A valley in the Swiss Jura, canton of Neuchâtel, drained by the Areuse flowing into the Lake of Neuchâtel. It is cultivated in parts, and there are important deposits of asphalt at St. Sulpice.

VALDIVIA. A province of Chile, lying between Cautin (north) and Llanquihué (south). In the east it is flanked by the Andes, among the foot-hills of which is a chain of lakes. Lake Rinihue is drained by the Valdivia River (100 miles), which, with its chief northern affluent, the Rio Croces, drains the most of the province. On it stands Valdivia, the capital (pop. 1930, 34,296), a busy manufacturing town (beer, leather, oils, ships, etc.), some 12 miles north of Porto de Corral, its port. Valdivia, town and province, has a large German element in its population. Lumbering and the clearing of land are prominent industries, which pave the way for the coming of the agriculturist and abundant crops of wheat. Leather, flour, beer, cattle, and timber are among exports. Area, 10,686 sq. miles; pop. (1930), 236,115.

VALDORF. A town in the Prussian province of Westphalia, on the Herford-Vlotho Railway. It has mineral springs and baths. Pop. 6000.

VALENCE (Rom. *Julia Valentia*). Chief town of the department of Drôme, France, on the Rhône; a junction on the P.L.M. Railway for Grenoble. It has an ancient Romanesque cathedral (S. Apollinaire), consecrated by Pope Urban II. in 1095. Manufactures include silks, beer, confections and jam, brandy, furniture, and leather, and there is a busy river trade. Pop. 34,275.

VALENCIA. A maritime province of Eastern Spain. Physically it comprises a low seaboard fringed with

sand-dunes, which have enclosed the Pool or *Albufera* of Valencia, and backed by a low coastal plain, which is flanked in the hinterland by highlands attaining, in parts, 400 feet altitude, the whole province draining to the Mediterranean by the Guadalaviar and Jucar river-systems.

On the coastal plain, where the climate is warm and dry, cereals, fruit, and oil are produced, and in the lacustrine areas near the sea rice is grown. Sericulture is progressive. In parts of the highlands the vine flourishes, and elsewhere sheep and goats are raised. Fishing around the coast, and iron-founding, distilling, and oil-refining are other important occupations.

Valencia is the capital; other towns are Alcira, Jativa, Cullera, Requena, and Utiel. Valencia is the railway nodal point, whence a network covers the province. Among others, lines run to Tarragona (171 miles by coastal route), Calatayud (183 miles; the junction for Zaragozá-Madrid), La Encina, via Alcira and Jativa (for Alcoy, 40 miles) (70 miles; the junction for Madrid-Alicante), and Liria (a circular route, via Manises or via Paterna). Area, 4150 sq. miles; pop. (1931), 1,053,725. *See* UTIEL; TERUEL.

VALENCIA. A city of Spain, capital of the province of Valencia, on the Guadalaviar. It is an archbishop's see, and has a cathedral (greatly injured by modernisation), a royal palace, an exchange, a general hospital, an academy of the fine arts, and other institutions. The university was founded in 1411. Other features are the bull-ring, a botanic garden, and the Alameda, a delightful walk bordered with orange, pomegranate, and palm trees. The chief manufactures are silk, linen, hemp, glass, cigars, paper, and soap. Valencia was founded by Junius Brutus, 140 B.C. Pop. (1931), 327,088.

VALENCIA. A city of Venezuela, capital of the state of Carabobo; served by rail to the first-class port of Puerto Cabello (34 miles), and by a second railway to Caracas. The city stands in the Maritime Alps near the west shore of Lake Tacarigua (or Valencia), which has an altitude of 1350 feet and an area of 216 sq. miles. A steamer plies daily. Valencia is the centre of a thriving agricultural region producing sugar-cane, coffee, etc., and has manufactures of agricultural implements and machinery, and woollens. There is a large trade. Nearby are the thermal springs of Las Trincheras. The climate is mild; mean annual temperature, 76° F. Valencia was founded in 1555. Pop. 36,804.

VALENCIA DE ALCANTARA. A town of Spain, in the province of Caceres, near the Portuguese frontier. It is an important frontier station and customs house on the trunk line Lisbon-Madrid, some 163 miles from the former and 250 miles from the latter. There are neighbouring phosphate-workings, and the Roman aqueduct (still in use) is of great interest. Pop. 10,000.

VALENCIENNES (vâ-lăn-syen). A town of France, in the department of Nord, on the Scheldt. It is a busy industrial centre, and has forges, foundries, steelworks, etc. Valenciennes was occupied by the Germans during the European War, but was retaken by Canadian troops on 4th Nov., 1918. Pop. 42,359.

VALENCY. In chemistry, a number expressing the combining power of an atom or radicle. Elementary explanations are given in the article *Chemistry*, and modern theories are referred to in the articles MATTER and IONISATION.

Many elements show varying valency—there are, for example, both ferrous and ferric salts. In certain groups of the periodic system (*see* PERIODIC TABLE) the sum of the hydrogen and the oxygen valencies of an element is eight, as in the pairs of compounds SiH_4, SiO_2; PH_3, P_2O_5; SH_2, SO_3; and ClH, Cl_2O_7. Abegg was thus led to the theory that every element possesses a maximum valency of eight, made up of *normal* and *contra*-valencies. For P, S, and Cl, these are -3, $+5$; -2, $+6$; and -1, $+7$; so that sulphur, for instance, having a negative valency of 2, but a positive valency of 6, combines with two atoms of hydrogen, but with three of oxygen.

In the most recent theory of atomic structure, the valency of the atom is supposed to be controlled by a certain number of its free or planetary electrons, by those, namely, which occupy the outermost of the series of shells in which the free electrons are arranged round the nucleus. The most stable arrangement is one in which the number of electrons in the outer shell is *eight*, and in many important cases chemical combination is due to the tendency of an atom to pick up or to part with electrons till this number is reached.

Certain elements, such as argon, have eight electrons in the outer shell in their ordinary state, and are therefore exceedingly stable and chemically inert; potassium has one, and chlorine seven. In KCl, the single electron from K is transferred to Cl, the outer

shell of which thus obtains its full complement; the atoms are then oppositely charged, and attract each other electrostatically. This is an example of what Langmuir calls *electro-valence*, which he contrasts with the *co-valence* manifested when the outer shells of two atoms or radicles in chemical combination hold electrons in common. An atom of fluorine, for example, has seven outer electrons, which we may suppose to occupy seven of the eight corners of a cube. The formation of the molecule of F_2 is explained by supposing the atomic cubes to be so arranged in pairs that the empty corner of each cube of a pair is attached to an occupied corner of the other, with the result that each atom has its eight corners filled, and each pair constitutes a highly stable molecule.

VALENS, Flavius. Roman Emperor of the East, born in Pannonia in A.D. 328, and declared Emperor of the East by his brother Valentinian I., who had already been elected emperor. The chief event of his reign was the war with the Goths under Athanaric, which lasted during the whole of Valens' reign. The Goths were several times defeated, and sued for peace, which was granted them (370). In 377 the Goths, driven southwards by the Huns, asked and received permission to settle on Roman territory. Irritated by the treatment they received at the hands of the imperial officials, they soon took up arms, and in 378 defeated Valens and destroyed the greater part of his army. Valens was never seen or heard of afterwards.

VALENTIA, or **VALENCIA.** A small island off the south-west coast of Ireland, belonging to County Kerry, about 5 miles long by 2 miles broad. It has slate- and flag-quarries, and productive fisheries. There are signalling and cabling stations. The British Atlantic telegraph cables to Newfoundland start from Valentia. It is also an important centre for meteorological observations. Pop. 1600.

VALENTINE, ST. A saint of the Roman calendar, said to have been martyred in A.D. 306. The custom of choosing valentines on his day (14th Feb.) has been accidentally associated with his name. On the eve of St. Valentine's day young people of both sexes used to meet, and each of them drew one by lot from a number of names of the opposite sex, which were put into a common receptacle. Each gentleman thus got a lady for his valentine, and became the valentine of a lady. The gentlemen remained bound to the service of their valentines for a year. A similar custom prevailed in the Roman Lupercalia, to which the modern custom has, with probability, been traced. The day used to be celebrated by sending anonymously through the post sentimental or ludicrous missives specially prepared for the purpose. But the practice died out about 1880.

VALENZA. A city of Piedmont, North Italy, in the province of Alessandria, on the Po. It has a cathedral of the sixteenth century. Pop. 11,210.

VALERIAN (*Valeriāna officinālis*). A plant of the order Valerianaceæ, native of Europe, which grows abundantly by the sides of rivers, and in ditches and moist woods in Great Britain. The root has a very strong smell, which is dependent on a volatile oil. It is used in medicine, in the form of infusion, decoction, or tincture, as a nervous stimulant and antispasmodic. Cats and rats are very fond of valerian.

VALERIA'NUS, Publius Licinius. Roman emperor from A.D. 253 to 260. He was taken prisoner by the Persians in 260, and his after fate is unknown.

VALERIUS FLACCUS, Gaius. Roman poet, flourished in the reigns of Vespasian and Titus. Nothing is known about his life, but as Quintilian, writing in A.D. 90, says "We have recently had a great loss in Valerius Flaccus," he must have died about A.D. 89. His epic poem the *Argonautica* was written between A.D. 70 and A.D. 79, and was dedicated to Vespasian. It is in eight books, but the last book ends abruptly, though it is uncertain whether it was never finished or whether the concluding books are lost. It was probably meant to be in twelve books, to bring it into line with the *Æneid*.

Valerius Flaccus borrowed his metre and diction from Virgil and his subject-matter from Apollonius Rhodius. He hardly equals the latter, let alone the former. His work is free from glaring faults, but he has too good a memory and too little imagination. He is dull, artificial, and unseasonably learned. The *Argonautica* is an example of mediocrity; at its best silver, at its worst leaden. —Cf. W. C. Summers, *A Study of the Argonautica of Valerius Flaccus*.

VALERIUS MAXIMUS. Roman author, who in about A.D. 30 compiled a collection of historical anecdotes entitled *De Factis Dictisque Memorabilibus Libri IX.* This book, though not entirely devoid of historic value, was intended to provide rhetoricians with an easy means of pointing a moral and adorning a tale. The style of Valerius is gaudy and

rhetorical, and forms a striking contrast to that of Cicero.

VALET'TA, or **VALLETTA.** The capital of Malta, on the north-east coast, situated on an elevated neck of land, with a large and commodious harbour on each side. From the inequality of the site the communication between the different streets is maintained by flights of steps. The cathedral, built in 1580, contains the tombs of the Knights of Malta or of St. John, and in a chapel are the keys of Jerusalem, Acre, and Rhodes. Other notable buildings are the Governor's residence, formerly the palace of the grand masters; the library, museum, university, and the military hospital.

The dockyard is capable of admitting the largest men-of-war. Some shipbuilding and various other industries are carried on, and the trade includes grain, wine, fruits, cotton and other manufactures, coals, etc. The mail steamers for Alexandria, Istanbul, etc., call here, and it is the chief station of the British fleet in the Mediterranean. The town was named after Jean Parisot de la Valette, Grand Master of the Knights of St. John of Jerusalem (1498-1568). Pop. (1931), 22,779.

VALGUARNERA. A town of Sicily, in the province of Caltanisetta; served by the Piazza Armerina branch of the Catania-Palermo Railway from Dittaino junction. Sulphur and olive-oil are produced. Pop. 14,000.

VALHALLA (*valhöll*, hall of the slain). In Old Norse mythology, the abode of Odin in Asgard, the palace of immortality, inhabited by the souls of heroes slain in battle, who here spent much of their time in drinking and feasting. It stood in *Gladsheim*, the home of joy. The name is applied figuratively to any edifice which is the final resting-place of many of the heroes or great men of a nation, and specifically to an edifice built by Ludwig I. of Bavaria, a few miles from Ratisbon.

VALKYR'IAS, or **VALKYRIES** (Ice. *valkyriur*, choosers of the slain). In Northern mythology, the fatal sisters of Odin, usually nine in number. They are represented as awful and beautiful maidens, who, mounted on swift horses and holding drawn swords in their hands, presided over the field of battle. They selected those destined to death and conducted them to Valhalla, where they ministered at their feasts, serving them with mead and ale in skulls.

VALLADOLID (vâl-yâ-*do*-lid'). A city of Spain, capital of the province of Valladolid. It has a cathedral, many churches and suppressed convents, and three hospitals. The university, which dates from 1346, was famous until the eighteenth century. It has six faculties and about 4600 students. Manufactures include silks, cotton and woollen goods, hats, jewellery, and paper. Pop. (1931), 89,342.

VALLEJO. A seaport-city of California, United States, in Solano county, on an arm of San Pablo Bay; served by the Southern Pacific Railway. It has a spacious harbour, and near it is Mare Island navy-yard. Large quantities of grain are shipped. The city was founded in 1851, and was the state capital till 1853. Pop. (1930), 14,476.

VALLEYFIELD. A town of Beauharnois county, Quebec, Canada, on the C.P.R., and served by steamers to Quebec, Montreal, Toronto, etc. It is the western terminus of Beauharnois Canal, and has cotton-mills, flour-mills, machine-shops, and foundries. Pop. 10,000.

VALLEYS. *See* GEOGRAPHY (*Surface of the Earth*).

VALLISNE'RIA. A genus of aquatic plants, of the nat. ord. Hydrocharidaceæ. They grow at the bottom of the water, and the male and female flowers are separate. When the time of fecundation arrives, the male flowers become detached and float on the water; the female flowers develop long spiral peduncles, by means of which they reach the surface, where they are fertilised by the male flowers. *V. spirālis* grows in still waters in Italy, and in the Rhone; it is commonly grown in aquaria.

VALLOMBRO'SA. Formerly an abbey in a wooded valley of the Apennines, belonging to the diocese of Fiesole, in the Florentine territory, where Giovanni Gualberto founded a house for monks in 1038, subject to the rule of St. Benedict. The building (dating from 1637) accommodates since 1870 an institute of forestry. Vallombrosa was visited by Dante, and is mentioned by Ariosto in *Orlando Furioso*, and by Milton in *Paradise Lost*.

VALMY. A village of France, in the department of Marne, celebrated for the affair known as "the cannonade of Valmy," where the French Republican troops under Kellermann defeated the Prussians in 1792. Kellermann was made Duc de Valmy in 1809.

VALONA. A seaport of Albania, on the Adriatic. Pop. 9100.

VALO'NIA. A substance used chiefly in tanning operations. *See* ACORN.

ALPARAISO. A city and seaport Chile; the largest and most imtant port on the west coast of th America, and the second city Chile. It is built round the enling hills (about 1200 feet) that ge the meagre sands of a semiular bay, and it is largely a city nerchants and traders—the Liverl of South America. There are te railway shops, foundries, and chine-shops, and many small instrial concerns; but the main siness of the city is transport, and activities have been stimulated by great increase of traffic now ning over the Transandine line and oiding either the dangers of the ait of Magellan or the lengthy cuit of the Panama Canal. The ain railway runs to Santiago, some 0 miles distant. Many steamship es serve the port.

Valparaiso was founded in 1536, d the name means literally "The alley of Paradise." The city has ffered much from earthquakes, and spite its prosperity it is still far om being what its name proclaims. op. (1932), 189,119.

VALPARAISO. A city of Indiana, nited States, the county seat of orter county; served by the Grand runk, Pennsylvania, and other railays. It is the seat of a university. ettled in 1835, it became a city in 865. Pop. (1930), 8079.

VALSA. A large genus of ascomyetous Fungi, group Pyrenomycetes, amily Sphæriales, comprising some 00 species, mostly saprophytes on ead twigs.

VALUATION. The process of asceraining the capital value, or the yearly alue, of property. It is done by rofessional valuators or appraisers or a variety of purposes, e.g. to guide prospective seller as to the market alue of the subjects he proposes to ell, or a prospective purchaser as to he price he should pay; to advise rustees and others as to the extent o which they may safely lend on real r heritable security; to determine he taxation to which property is iable, e.g. on a death, or for property ax, inhabited house duty, local rates, etc.; to determine yearly rent; to assess compensation for dilapidations or for compulsory acquisition, etc.

Valuations are liable to stamp duties varying from 3*d.*, where the value does not exceed £5, to 20*s.*, where it exceeds £500, unless made for the information of one party only and not obligatory between parties, or made under order of the Court of Admiralty, or for the payment of death duties or income tax, or in a bankruptcy. The cost of the licence which every valuator other than an auctioneer or an attorney must take out annually is £2. *See* RATES.

VALVES AND VALVE GEARS. A valve is a contrivance by which the flow of a liquid or a gas through a pipe may be regulated by a movable part which opens or closes the passage way. The hinged or reflux valve, the butterfly valve, mushroom valve, double-beat valve, and disc valve are a few of the automatic types in everyday use. Among non-automatic valves are stop valves, reducing valves, and throttle valves. The stop valve consists of an ordinary lift valve opened or shut by means of a screwed spindle which works in a nut in the body of the valve. The reducing valve is used to reduce the pressure of a gas below that of the main supply. The throttle valve, which is generally an elliptical plate fixed upon a central spindle, is used to reduce the speed of an engine by checking the flow of steam or gas.

In fig. 1 is shown a simple slide valve as used in a steam-engine for

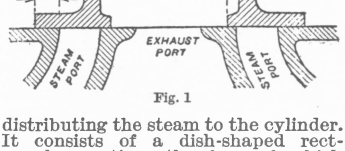


Fig. 1

distributing the steam to the cylinder. It consists of a dish-shaped rectangular casting, the face of which slides backward and forward on a seating formed in the steam chest. When the valve is placed in its mid position, the distance that the outer edge extends beyond the outer edge of the steam port is called the outside or steam lap, and the distance that the inner edge extends beyond the inner edge of the port is called the inside or exhaust lap. It is customary in large engines to use relief frames at the back of the slide valve to prevent loss of power necessary to overcome friction. This loss is further reduced by making the valve double-ported or by using a trick valve.

In Meyer's expansion valve the cut off can be varied while the engine is running. When high-pressure steam is used, the slide valve has to give place to the piston valve (fig. 2), or to the drop valve, which is well balanced and easy to operate. Rocking valves are used with the Corliss valve gear, giving a sharp cut off. In the Stephenson link motion (fig. 3) two eccentrics are used. The eccentric rods are connected by a

slotted link curved to a radius equal to the length of a rod ; this link can be moved up or down by a lifting link. The valve rod end is coupled to a die-block which slides within

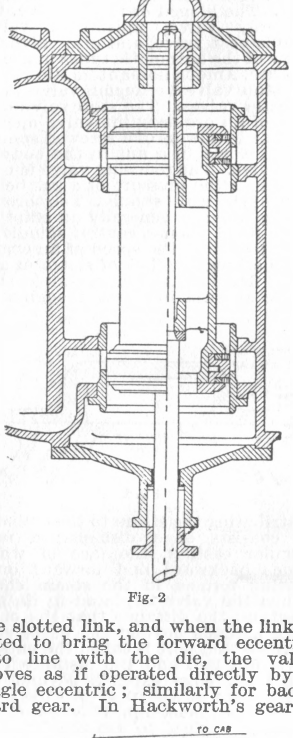


Fig. 2

the slotted link, and when the link is lifted to bring the forward eccentric into line with the die, the valve moves as if operated directly by a single eccentric ; similarly for backward gear. In Hackworth's gear a

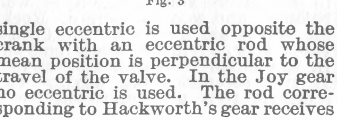


Fig. 3

single eccentric is used opposite the crank with an eccentric rod whose mean position is perpendicular to the travel of the valve. In the Joy gear no eccentric is used. The rod corresponding to Hackworth's gear receives its motion from a point on the necting-rod. In the Walschaert (fig. 4) the valve receives its mo from an eccentric which actuate rocking link. *See also* MOTOR-ENGINES and WIRELESS TELEGRAF

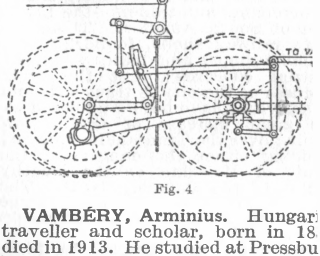


Fig. 4

VAMBÉRY, Arminius. Hungar traveller and scholar, born in 18 died in 1913. He studied at Pressbu Vienna, and Budapest, and then we to Constantinople, where he lived teaching French. From 1861 to 18 disguised as a dervish, he underto an extensive journey of explorati through Persia into Turkestan, a visited Khiva, Bûkhara, and Sam kand. In 1865 he became professor Oriental languages at the Universi of Budapest. His works includ *Travels in Central Asia* (1865), *Wa derings and Adventures in Pers* (1867), *Islam in the Nineteenth Ce tury* (1875), and *The Coming Strugg for India* (1885). His *Life and Adve tures* appeared in 1883, *The Story My Struggles* in 1904.

VAMPIRE-BAT. A name for certa bats of the family Phyllostomatid inhabiting South America. The nam was given from the blood-suckin habits attributed to these bats, bu how many of them really attac animals and suck blood from them not quite clear. One species at leas known as the vampire-bat (*Vampyru spectrum*), of large size and havin formidable teeth, seems to be cor clusively acquitted of the charge, i regular food being fruits and insect It has large leathery ears, an erec spear-like appendage on the tip the nose, and wings measuring 2 inches when extended.

Several bats, however, have bee proved to be blood-suckers, the bes known being *Desmodus rufus*, species only about 4 inches long an 15 or 16 inches in expanse of win It has large prominent upper incisor of peculiar shape, and upper canine somewhat similar, and the stomac and intestines are evidently speciall adapted for a diet of blood. Th species of bat seems to be generall distributed throughout the warme parts of South America from Chile t

Guiana. The blood-sucking propensities of these bats are by no means so dangerous as formerly and popularly described; but there is little doubt that they do attack horses and cattle, and even sleeping human beings.

Vampire-bat

VAN. A town of Turkey in Asia Minor, situated near the eastern shore of Lake Van. Excellent carpets and cotton cloth are made and exported from the Van district, which is specially noted for embroidery and tapestry. Pop. 22,000.—Lake Van is a salt-water lake, 5270 feet above sea-level; area, 1426 sq. miles. It contains many islands, and has no visible outlet.

VANADINITE. An orange-coloured mineral, consisting of vanadate and chloride of lead, isomorphous with apatite, and one of the commercial sources of vanadium.

VANADIUM. A metallic element (chemical symbol, V; atomic weight, 51·0), the compounds of which are widely distributed, but in small quantity, in a variety of minerals. Its most abundant ore is *vanadinite*, which contains about 17 per cent of vanadic acid. The metal is silver-white in appearance, and is not easily oxidised in air; its specific gravity is 5·5, and melting-point 1720° C. Small quantities of vanadium (about 0·2 per cent) added to steel increase the tensile strength and elastic limit, and the alloy, called vanadium steel, is used for the construction of springs, car axles, and other parts subject to varying stresses. The compounds of vanadium are poisonous.

VANBRUGH, Irene. English actress. The younger daughter of the late Prebendary Barnes of Exeter, she was born in 1872. She started her theatrical career at Margate, as Phoebe in *As You Like It*. She is a leading comedy actress, combining fine technique with great natural charm. Amongst her numerous parts have been Lady Rosamund in *The Liars*, Sophy Fullgarney in *The Gay Lord Quex*, Lady Mary Lazenby in *The Admirable Crichton*, and Belinda (1918). She toured the southern colonies in 1923-25, and again in 1927-29. She played in *The Swan* (1930) and as the Queen in *Hamlet* (1931).

VANBRUGH (van-brö′), **Sir John.** British dramatist and architect, born in 1664, and died in 1726. His grandfather had migrated to England from Ghent. Vanbrugh was educated at the King's School, Chester, and after visiting France, obtained a commission in the infantry. In 1690 he was arrested on a charge of espionage, and spent some time in the Bastille as a prisoner.

His earliest comedy, *The Relapse: or, Virtue in Danger*, was produced in 1696. It was a sequel to Cibber's *Love's Last Shift: or, The Fool in Fashion*, but it at once surpassed its forerunner in popularity. Lord Foppington was a famous character; scarcely less so were Miss Hoyden and her father, Sir Tunbelly Clumsey. The play was frequently acted, and was recast by Sheridan as *A Trip to Scarborough*. *Æsop* (1697), a dramatic sermon, was a failure because the sermonising element outweighed the dramatic. *The Provok'd Wife*, produced in the same year, is perhaps Vanbrugh's masterpiece, and certainly contains his greatest character, Sir John Brute. This play was partly the cause of Collier's unreasonable and unsuccessful attack on the stage.

Vanbrugh's next plays were all adaptations: *A Country House* and *The Confederacy* from Dancourt, *Squire Trelooby* from Molière's *Monsieur de Pourceaugnac*, and *The Mistake* from his *Dépit Amoureux*. All these are excellently done, and are not mere journey-work; in many details they improve upon their originals. Vanbrugh's last play, *A Journey to London*, was left incomplete at his death, but was completed and produced by Cibber as *The Provok'd Husband*.

Vanbrugh became Comptroller of the Royal Works in 1702, and built Castle Howard for the Earl of Carlisle. His chief architectural works were a theatre in which acoustic requirements were neglected, and Blenheim Palace, which brought him into unpleasant relations with the Duchess of Marlborough, and which was a source of worry, expense, and litigation for years. Lord Carlisle had him made Clarenceux King-at-Arms, and in this

capacity he took the insignia of the Garter to the Elector of Hanover, afterwards George I. When George ascended the throne in 1714 he knighted Vanbrugh. Vanbrugh built many other country mansions, and became architect to Greenwich Hospital in 1716.

As an architect he seems to have suffered from a kind of megalomania. He was much more successful as a dramatist. The immensity of his Cyclopean architectural work bears no relation to the finish and neatness of his comedies. He was not a literary man or a great stylist; but his active career as man of affairs, soldier, herald, architect, and playwright gave his work in the last-named capacity an inimitable *vis comica*.—BIBLIOGRAPHY: G. H. Lovegrove, *The Life, Work, and Influence of Sir John Vanbrugh*; I. D'Israeli, *Curiosities of Literature*; A. E. H. Swain (editor), *Select Plays of Sir John Vanbrugh* (Mermaid Series).

VANBRUGH, Violet. Actress, sister of Irene Vanbrugh, born at Exeter in 1867. Her first stage appearance was at Toole's Theatre in 1886 and from that date she has played in a great variety of plays. She has taken Shakespearean rôles. She married Arthur Bourchier, the actor manager.

VAN BUREN, Martin. Eighth President of the United States, born at Kinderhook, New York, 1782, died 1862. He early studied law, and in 1812 was elected to the state Senate. He was Attorney-General from 1815 to 1819, and in 1821 was elected United States Senator. In 1828 he became Governor of New York, and in the following year President Jackson appointed him Secretary of State.

In Nov., 1832, he was elected Vice-President, and in 1836 became President of the United States. The difficulties which his administration had to face were chiefly connected with the deposit of State funds in private banks, and his method of dealing with these brought about his defeat at the next election in 1840. He was again nominated by the Democrats in the elections of 1844 and 1848, but was unsuccessful on both occasions. He wrote a treatise entitled *An Inquiry into the Origin and Course of Political Parties in the United States* (1867).

VANCOUVER, George. English navigator, born about 1758, died 1798. He entered the navy as midshipman in 1771; accompanied Cook on his second and third voyages (1772-4 and 1776-9); was made first lieutenant in 1780; and served in the West Indies until 1789. In 1790 he was put in command of a small squadron sent to take over Nootka from the Spaniards, and was also charged to ascertain if there was a north-west passage. He sailed in the *Discovery*, 1st April, 1791, spent some time at the Cape and afterwards made for Australia and New Zealand, parts of the coasts of which he surveyed. Having received formal surrender of Nootka, he spent the summers of 1792-4 in surveying the coast as far north as Cook's Inlet, wintering at the Sandwich Islands. He returned by way of Cape Horn, and reached England in 1795, where a narrative of his voyage was published in 1798. Vancouver Island was named after him.

VANCOUVER. A city of British Columbia, on Burrard Inlet, which opens on the Strait of Georgia, and forms a fine harbour. It is a terminus of the Canadian Pacific, National, and other railways. There is a large trade with American and Asiatic ports in timber, coal, fruit, etc. Vancouver dates back only to 1885. It has a broadcasting station (49·43 m.). Pop. (1931), 300,000 (with suburbs).

VANCOUVER ISLAND. An island in the Pacific, off the west coast of British Columbia, of which province of Canada it forms part; length, from 250 to 300 miles; area, 13,500 sq. miles. It is generally mountainous, and heavily timbered. The climate is temperate, and the soil, in the south and east, fertile and favourable to agriculture and fruit-growing. The interior is rocky, interspersed with small grass tracts suitable for pasturage, and with lakes and small streams. Much coal is raised and exported at Nanaimo on the south-east coast, and gold, copper, iron, and other minerals are found. Horses, cattle, and sheep thrive well, and the seas and lakes abound with fish. Salmon are exported, and there is a trade in furs. Settlement is almost confined to the south-east, where are situated Victoria, Esquimault, and Nanaimo, all connected by railway. The first is the capital of British Columbia. Pop. about 50,000.

VANDALS. An ancient Teutonic or Germanic people. They were allied to the Goths, lacking, however, the better qualities of the latter, and occupied at an early period the country on the south of the Baltic, between the Oder and the Vistula. At a later period they appear to have descended into Silesia, and subsequently occupied Pannonia, Moravia, and Dacia. In A.D. 406, in conjunction with a German host, they ravaged Gaul, and thence found their way into Spain. After defeating an allied army of Goths and Romans, they seized Sevilla and Carthagena, and, led by

Genseric (400-477), crossed to Africa. Here they vanquished the Roman governor (429), and founded a kingdom, which absorbed the greater part of the Roman possessions.

Genseric immediately began to revive the maritime glories of Carthage, and extended his conquests to Sicily, Sardinia, and Corsica. He also invaded Italy and sacked Rome in 455. The kingdom of the Vandals was continued under his descendants—Hunneric, his son, who immediately succeeded him; Gundamund, 484; Thrasimund, 496; Hilderic, 523; Gelimer, 530. It was overthrown in 534 by Belisarius, the general of the eastern Emperor Justinian.

VANDAMME, Dominique Réné, Comte d'Unebourg. French general; born 1770, died 1830. He entered the army in the ranks at the age of eighteen years and served abroad, returning to France during the revolutionary period (1792), and espousing the republican cause. In 1799, after a strenuous period of fighting, he became general of division, and subsequently served in succession under Brune, Moreau, and Macdonald, being decorated by Napoleon with the grand-eagle of the Legion of Honour in 1805 for his conspicuous services at Austerlitz. The two following years saw him in command of the 9th Corps (Westphalian) of the Grand Army in Germany and Poland, and his subjugation of Silesia is generally considered his finest military achievement.

After the battle of Dresden, Vandamme, whom Napoleon had sent with the 3rd Corps into the mountains, essayed an attack on the flank of the retreating Austrians and Russians, but was overwhelmed at Kulm by weight of numbers and compelled to surrender with 10,000 men (29th Aug., 1813). He was interned until the end of the war, when he returned to France, but rejoined the Napoleonic Eagles during the Hundred Days, commanded the 3rd Corps at Ligny, and after Waterloo (where he was not engaged) he suffered a second exile until 1824.

VANDERBILT, Cornelius. American capitalist; born 1794, died 1877, amassed immense wealth in connection with shipping and railroads, a share of which he left to his eldest son William Henry, born 1821, died 1885, who was supposed at his death to be the wealthiest man in the world. The Vanderbilt University (Methodist Episcopal) at Nashville, Tennessee, was founded by Cornelius Vanderbilt.

VANDERVELDE, Émile. Belgian statesman. He was born 25th Jan., 1866, near Brussels. In 1886 he joined the Belgian Labour Party, and soon became its leader. He entered Parliament in 1894. He was a member of the Cabinet during the World War, and afterwards, as Minister of Justice, effected many humanitarian and scientific reforms in the prison system. In 1925 he played an important part in negotiating the Locarno Pact. He has written on labour questions and on Marxism.

VAN DYCK (van dīk'), **Sir Anthony.** Flemish painter; born at Antwerp 1599, died in London 1641. He studied painting first under Van Balen, and then under Rubens, to whom he acted as assistant. During this period his work is at times almost indistinguishable from that of Rubens, though on the whole less exuberant and more sentimental. About 1621 he went to Italy, working chiefly at Genoa, Venice, and Rome, and about 1627 returned to Antwerp. In Italy, Titian and Tintoretto influenced his colour and use of light and shade, and contributed towards the development of an art marked by dignity, elegance, and great technical accomplishment, which reached maturity during Van Dyck's second stay in Antwerp.

In 1632 he was invited to England by Charles I., who appointed him his principal painter-in-ordinary, and bestowed upon him the honour of knighthood, a considerable annuity, and a summer and winter residence. In England he fully maintained his reputation in a series of portraits of Charles I. and his court, of which good examples are in the National Gallery, and in the Royal Collection; though at times he descended into superficiality and mannerism. Though primarily a painter, Van Dyck was also an accomplished etcher and engraver. In England he founded a tradition in portraiture which more or less persisted for two hundred years after his death. — BIBLIOGRAPHY: Lionel Cust, *Anthony Van Dyck*; Max Rooses, *Antoine Van Dyck*.

VANDYKE BROWN. A pigment obtained from a kind of peat or bog-earth, of a fine, deep, semitransparent brown colour; so called from its being supposed to be the brown used by Van Dyck in his pictures.

VANE, Sir Henry. English statesman and writer; born in 1613, died in 1662. The eldest son of Sir Henry Vane, Secretary of State, he was educated at Westminster and Oxford, and afterwards at Geneva, where he became a Puritan. Emigrating to the United States, he was elected Governor of Massachusetts in 1636. In 1637 he returned to England, was knighted,

entered Parliament, and became Treasurer of the Navy. He took part in the impeachment of Strafford, and was a zealous supporter of Parliament in the Civil War and one of the leaders in the Long Parliament. He was averse to the execution of the king, and came into conflict with Cromwell in consequence of the forcible dissolution of the Long Parliament (1653).

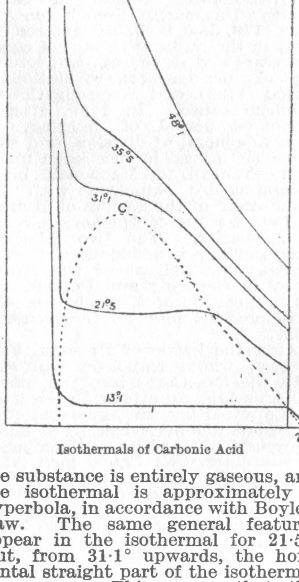
In 1656 he was imprisoned in Carisbrooke Castle for four months, by order of Cromwell, on account of a pamphlet he had written. On his release he continued resolutely to oppose the government of Cromwell and of his son Richard. After the Restoration he was sent to the Tower (Feb., 1660), and subsequently tried for high treason before the Court of King's Bench (2nd June, 1662), condemned, and beheaded on Tower Hill on 14th June.—Cf. John Willcock, *Life of Sir Henry Vane, the Younger, Statesman and Mystic.*

VANILLA. A flavouring agent used in confectionery and in the preparation of liqueurs, procured from the fruit of *Vanilla planifolia* and allied species, orchidaceous plants of tropical America, remarkable on account of their climbing habit, and now cultivated in various tropical countries, including Ceylon and India. It has a fragrant odour, and is also used in medicine as a stimulant and promoter of digestion.

VANNES (vân). A seaport of France, capital of the department of Morbihan, Brittany, an interesting old place, now surrounded by modern suburbs. There is a cathedral, and a museum rich in Celtic antiquities. Pop. 22,413.

VAPORISATION. The process by which a liquid changes into a vapour (*see* EVAPORATION; BOILING-POINT). One of the earliest experimenters on the relationship between the liquid and gaseous states of matter was Cagniard de la Tour, who heated volatile liquids in very strong closed tubes about half filled. He observed that at certain temperatures (36° C. for alcohol, and 42° C. for ether) the liquid suddenly disappeared, so that at these temperatures the two states were apparently continuous with one another.

The great name, however, in this section of physics is that of Dr. Thomas Andrews (q.v.). By a series of elaborate experiments on carbonic acid, Andrews showed that at a temperature above 31° C. this gas cannot be liquefied by any increase of pressure, but, when the pressure is very great, assumes a condition in which, though uniform throughout, it is neither a liquid nor a gas. The results were shown graphically on a (p, v) diagram (*see* THERMODYNAMICS) in which the isothermals for various temperatures were drawn, somewhat as shown in the figure. The isothermal for 13·1° C. is, to the left, practically a vertical line, the substance being liquid, and the volume hardly diminished even by great increase of pressure; in the middle, it is a horizontal line, implying constant pressure, the liquid being in presence of its saturated vapour; to the right,



Isothermals of Carbonic Acid

the substance is entirely gaseous, and the isothermal is approximately a hyperbola, in accordance with Boyle's Law. The same general features appear in the isothermal for 21·5°. But, from 31·1° upwards, the horizontal straight part of the isothermal disappears. This means that the change of volume between the point at which gaseous carbonic acid begins to condense at constant temperature under increasing pressure, and the point at which the gas is completely condensed, i.e. the change of volume between the points where a horizontal line cuts the dotted curve, gets smaller as the temperature rises from low values. The point at which this change of volume disappears entirely, viz. the apex C of the dotted curve in the figure, is called the *critical temperature* of carbonic acid; and the pressure and density at the same

oint are called the *critical pressure* nd *critical density*. *See* STEAM.

Critical Temperatures and Pressures

	Temperature (centigrade)	Pressure (atmospheres)
Helium	—268	2·3
Hydrogen ..	—234·5	20
Nitrogen ..	—146	33
Air	—140	39
Oxygen	—118	50
Carbon dioxide ..	31	73
Ammonia ..	130	115
Sulphur dioxide	155	79
Water	365	195

VAR. A maritime department in the south-east of France, bordering upon the Mediterranean, and covered in the interior with ramifications of the Alps; area, 2333 sq. miles, of which only a small portion is arable. There are magnificent forests of pine and oak, and the vine, olive, mulberry, and tobacco are extensively cultivated. Minerals include salt, lead, coal, marble, gypsum, and building-stone. The manufactures consist of woollens, perfume, liqueurs, olive-oil, soap, leather, and silk. Fishing (tunny and anchovies) is carried on. Capital Draguignan. Pop. (1931), 377,104. *See* BRIGNOLES; HYERES; TOULON.

VARANGIANS. The name applied to the Norse vikings who, at the close of the ninth century, founded various principalities in Russia. The word is derived from the Old Norse *væringjar*, and means retainers. Some of the Varangians afterwards entered the service of the Byzantine emperors, and became the imperial guards at Constantinople. Here they were recruited by Anglo-Saxons and Danes, who fled from England to escape the Norman yoke.

VARAZDIN. A town of Yugoslavia, in Croatia. It has manufactures of tobacco, liqueurs, vinegar, and silk wares. Pop. 13,645.

VARDAR. A river of Yugoslavia (Serbia) and Greece (Macedonia), rising in the grassy plain of Tetovo (behind the Shar Mountains), flowing first in an easterly direction and then south to the plain of Skoplye, passing Skoplye town and the town of Veles, and crossing Macedonia to its delta in the Gulf of Salonika; length, 200 miles. It forms the chief river of Macedonia, and its valley has been for centuries one of the main routes between the Ægean and the Danube. The Tsrna (on the right) and the Lepenats and Bregalnitsa (left) are the chief affluents. Some gold-washing is carried on in the lower reaches. During the European War (q.v.; see sections *The Balkans, 1915*, and *The Balkans, 1918*) the Vardar Valley was the scene of heavy fighting.

VARDÖ. A town and port of North-Eastern Norway, well within the Arctic Circle. It stands on Vardö Island (3 miles broad) on the northern side of the entrance to Varanger Fiord (55 miles long; extreme depth, 230 feet), and the port, ice-free all the year round, is served by steamer to Hammerfest (190 miles). Fish, especially cod from the rich Varanger fisheries, and by-products, such as oil and guano, are exported. Pop. 3000. Near by is Vardöhus, the most northerly fortress in the world, founded in 1310.

VARESE. A province of Lombardy, Italy; area, 462 sq. miles; pop. (1931), 382,462.

VARIABLE STARS. Many stars vary from time to time in their brightness. The most famous is the star β Persei, called by the Arabic name of Algol, the Demon, evidently because the ancients were impressed by its (so to speak) winking eye. This star, which is typical of the regular and short period variables, goes through a constantly repeated set of changes in a period of 2 days 20 hours 48 minutes. For over 2 days it shines as a star of the second magnitude; then it loses in a little over 4 hours about two-thirds of its light, remains at minimum for 20 minutes, and in a little over 4 hours regains its former brightness. The spectroscope shows that the diminution of light is caused by a dark companion. Algol and the dark body revolve round the common centre of gravity, and Algol is partially eclipsed in every revolution.

The long-period variables are in many cases very irregular, both in the brightness of maximum and minimum and in the period of passing through the phases. The best known is o Ceti, called Mira (the Wonderful). It varies upon an average between the second magnitude and the eighth or ninth, the mean period being 331 days. These variables are certainly not to be explained by eclipses by a dark satellite. According to a theory of Sir Norman Lockyer, they might be due to revolution of a dense swarm of meteors in an elliptic orbit, which renders the star's atmosphere incandescent by friction at their closest approach. It is generally considered that the variation is caused by an intrinsic pulsation of the star, possibly even the alternate formation and destruction of a solid crust on a fluid orb.

When minute variations are taken into account, probably by far the

greater number of the stars are variables. Our own sun, with its 11-year sunspot fluctuation, doubtless varies continuously in its output of heat and light. For bibliography, *see* STARS.

VARIATION AND SELECTION. *See* ENVIRONMENT; EVOLUTION; HEREDITY; MENDELISM; NATURAL SELECTION; SEXUAL SELECTION.

VARIATIONS, CALCULUS OF. A branch of mathematics which deals with a certain type of problem of maxima and minima. An unknown function has to be determined in such a way that a definite integral of given form involving the function and one or more of its derivatives shall have a maximum or minimum value. A celebrated example is the problem of the *brachistochrone*—to find the curve joining two points in a vertical plane along which a heavy particle will descend from the one point to the other in the shortest time. The curve is a cycloid.—Cf. I. Todhunter, *History of the Calculus of Variations.*

VARICOSE VEINS. Veins in a diseased state, which become dilated and uneven, and form hard knotty swellings in the situation of their valves. The disease is a common affection of the lower limbs, where sometimes the varix bursts and hæmorrhage takes place. It also occurs in the veins of the scrotum and lower rectum, producing in the latter case bleeding piles. Varicose veins are caused by local obstruction of the circulation of the blood, and are common in pregnancy, while stout people, and those who stand most of the day at work, are apt to suffer from them. The treatment consists in the application of proper bandages, and rest to the limb supported in an elevated position.

VÄRMLAND, or VERMLAND. An inland län or county of Sweden, drained by the Klar. The surface is studded with innumerable lakes, and a large area of Lake Vener is included in the southern end of the län. Carlstad (pop. 20,000) is the capital; other towns are Kil, Deje, and Christinehamn (11,800). Kil is an important junction on the Falun-Göteborg Railway (via Deje) and on the Laxa-Charlottenberg line (for Oslo), via Carlstad (for Filipstad, via Deje) and Christinehamn (for Mora-Noret line). Area, 7427 sq. miles; pop. (1931), 270,414.

VARNA. A seaport of Bulgaria, on the Black Sea. It has a good harbour, and a large trade with Istanbul in grain. It is the see of a Greek archbishop. It was taken by the Russians in 1828, but restored to Turkey a year later by the Pea Adrianople. The Crimean exped sailed from Varna in 1854. (1926), 60,563.

VARNISH. A liquid applied thin coating, which, on drying, fo a hard, shining layer protecting object from atmospheric influenc

(1) *Oil varnishes* consist of volatile drying oils, e.g. linseed which are heated either alone, more usually with oxidising stances, such as litharge, manga salts, etc., to increase the dry properties of the oil. By incorpo ing a pigment with an oil varnis paint is obtained.

(2) *Lac varnishes*, or lacquers, made by dissolving various resin linseed-oil varnish, and are harder more durable than the latter.

(3) *Volatile varnishes*, such as "c tal" varnish and "spirit" varni are prepared by dissolving resins, shellac, sandarac, colophony, or da mar, in oil of turpentine or meth lated spirit, or in a mixture of th solvents. These varnishes dry ve quickly and give a hard, glossy s face; the addition of a little mas or boiled linseed-oil renders them l liable to crack.

Within recent years cellulose pain composed of cellulose nitrate or ac tate dissolved in suitable solven with added oils, gums, and colouri matter, have been largely used f protective and decorative purposes the place of varnish.

VARRO, Marcus Terentius. One the most learned men and prolif writers of ancient Rome, born 11 B.C., died 27 B.C. He served in th army, and subsequently filled sever public offices. Varro was the intimat friend of Cicero, and was proscribe by Antony, but he escaped and re turned to Rome under Augustus. C his numerous writings, chiefly o language, history, and philosophy only one has come down to us entir —a treatise upon agriculture (*D Re Rustica*). Fragments of a treatis on the Latin language (*De Lingu Latina*) are also extant.—Cf. J. W Duff, *A Literary History of Rome.*

VARUS, Publius Quintilius. Roma general, celebrated in consequence o the great defeat that he suffered a the hands of Arminius, leader of th Germans. In 7 B.C., having receive from Augustus the command to in troduce the Roman jurisdiction int the German territory just conquere by Drusus, he was carrying out hi mission when he was suddenly attacked by an immense host unde Arminius, and his whole army wa destroyed. Varus put an end to hi own life.

VASA'RI, Giorgio. Italian painter and architect, but chiefly famous as the biographer of artists, born at Arezzo in 1512, died at Florence in 1574. He studied under Luca Signorelli, Michelangelo, and Andrea del Sarto. As an architect he showed considerable ability, as exemplified in his designs of the Palazzo degli Uffizi at Florence, and the church of the Badia at Arezzo. His paintings are less successful, as exemplified by his frescoes in the cathedral of Arezzo, in the Palazzo Vecchio in Florence, and in the Vatican; nor are his easel paintings, such as those in S. Croce and S. Maria Novella, Florence, more impressive. His *Vite de' più eccellenti Pittori, Scultori ed Architetti* (Lives of the most excellent Painters, Sculptors, and Architects) is, however, of the greatest interest and value, though containing many errors respecting the earlier masters and showing considerable partiality towards the Tuscan artists. It was first printed in 1550, and an enlarged and improved edition appeared in 1568. A standard edition is that of Milanesi (1878-85). It has been translated into English.

VASCULAR or **CONDUCTING TISSUES,** of plants, comprise (1) the *xylem* or wood, (2) the *phloem* or bast. The most important constituents of xylem are *wood-vessels* or *tracheæ*, long tubes, devoid of living contents, formed by the coalescence of numerous cells through absorption of the end-walls. These are usually accompanied by shorter conducting elements called *tracheïds* with unbroken end-walls; the xylem of most Gymnosperms and Pteridophytes contains tracheïds only. Wood-vessels and tracheïds transport *sap*, i.e. the water with mineral salts in solution absorbed by the roots, to all parts of the plant and especially to the leaves, where the superfluous water is got rid of by evaporation (*transpiration*), and the salts worked up with carbohydrates formed by carbon-assimilation into the various nutritive or *plastic* materials.

The chief function of the phloem is to transport these plastic substances to the growing points (*meristems*), the developing flowers and seeds, storage organs, and other parts where they are required for immediate or future use. The most important elements of the phloem are the *sieve-tubes*, long rows of cells with finely perforated end-walls and contents rich in proteins, sugar, etc. These conducting tissues proper, together with other cells, such as fibres (for mechanical support) and parenchyma (for storage, etc.), are regularly associated to form the *vascular bundles* of herbaceous stems, leaves, etc., or the massive *secondary tissues* of woody stems and roots. *See* BOTANY; PHLOEM; XYLEM.

VASSAR COLLEGE. A non-sectarian institution for the higher education of women, situated 2 miles east of Poughkeepsie, New York, and 75 miles from New York City. It was founded by Matthew Vassar (1792-1868), a wealthy brewer, and was opened in 1865. It has a staff of 187 instructors, and 1150 students. Its library contains over 150,000 volumes.

VÄSTERBOTTEN. A län or government of Northern Sweden. It is a lumbering region. Umeå (pop. 3000), on Umeå River, is the capital and chief seaport, exporting timber and tar. The mean annual temperature at Umeå is 35·0° F. (Feb., 15·8°; July, 58·2°). Area, 22,838 sq. miles; pop. (1931), 205,454.

VÄSTERNORRLAND. A län or government of Central Sweden. It is a lumbering region. Hernösand (q.v.) is the capital (mean annual temperature, 37·4° F.; Feb., 18·0°; July, 59·2°); other towns are Sundsvall (q.v.) and Örnsköldsvik (a port). Area, 9924 sq. miles; pop. (1931), 279,590.

VÄSTMANLAND. A län or government of Central Sweden. Vesterås is the chief town; others are Sala (where argentiferous lead and copper are extracted from the Salberg), Tillberga, Kölback, Köping, and Rydarhytan. Area, 2609 sq. miles; pop. (1931), 161,297.

VATERIA. A genus of plants, nat. ord. Dipterocarpaceæ. Two species, *V. indica* and *V. lanceæfolia*, belong to India, forming large trees, valuable both for their timber and for the products which they yield. *V. indica*, whose timber is much employed in shipbuilding, produces the resin called in India *copal* and in England *gum animé*. It also yields a fatty substance called *piney-tallow*.

VATICAN, PALACE OF THE. Official residence of the Pope in Rome, and seat of museums and the great Vatican Library. It is built upon the Vatican Hill, from which it received its name, on the opposite side of the river from the bulk of the city, immediately to the north of the cathedral of St. Peter's. The first Pope to build a residence on the site was Symmachus (498-514), but for a long time the Popes resided mainly in the Lateran. After the return of the Popes from Avignon, the Vatican became their permanent residence, although several Popes resided at the Quirinal.

The present buildings were begun by Pope Nicholas V. (1447-55), and have been enlarged and embellished by many subsequent Popes down to Pius IX. The Vatican now possesses twenty courts and, it is said, over 7000 rooms. Immense treasures are stored in it, with celebrated collections of pictures of many of the great masters, and museums in which all periods of the arts are represented by many of their most perfect productions. Among the noblest art treasures are the frescoes on the ceiling of the Sistine Chapel, painted by Michelangelo; and the frescoes painted by Raphael on the ceilings and walls of certain apartments known as Raphael's *stanze*. The apostolic residence, containing the private

Vatican, Rome

apartments of the Pope, is in the eastern wing of the court of St. Damasus.

Library. The Vatican Library, first constituted by Pope Nicholas V., was added to and enlarged by Leo X., Pius IV., Pius V., and other Popes. In December, 1931, some thousands of volumes were destroyed through the collapse of part of the building. Since then the library has again been enlarged. It contains now about 35,000 MSS. and about 250,000 printed books.—Cf. D. B. W. Sladen, *How to see the Vatican*.

VAUBAN, Sébastien le Prestre, Seigneur de. French soldier and military engineer, born in 1633, died in 1707. He early entered the army, where he rose to the highest military rank by his merit and services. He was made Governor of the citadel of Lille in 1668, Commissioner-General of Fortifications in 1677, and marshal of France in 1703. As an engineer Vauban carried the art of fortification to a degree of perfection unknown before his time. He strengthened and improved above 300 citadels, erected thirty-three new ones, and directed fifty-three sieges.

VAUCHERIA. A genus of Green Algæ, group Siphonales. The plants, which consist of rather coarse branched non-septate filaments, grow generally on damp soil, being particularly common on the earth of flower-pots in greenhouses. They are oogamous, a rather unusual feature in the Siphonales.

VAUCLUSE (vō-klüz). A department in the south-east of France; area, 1381 sq. miles. It is rugged and mountainous in the east. The mulberry (for the rearing of silk-worms) and olive are extensively cultivated, and much attention is paid to the culture of aromatic and medicinal plants and of the vine. Vaucluse takes its name from the valley and village of that name, rendered celebrated by Petrarch. Avignon is the capital. Pop. (1931), 241,689.

VAUD, or **PAYS-DE-VAUD** (pe-ē-dė-vō; Ger. *Waadt* or *Waadtland*). A western canton of Switzerland; area, 1238 sq. miles. It has three mountain systems—the Alps in the south-east, the Jura in the west, and the Jorat in the south; and partly embraces the Lakes of Geneva and Neuchâtel, belonging both to the basins of the Rhine and the Rhône. The vine is extensively cultivated in the south. There are no manufactures of importance. The people are mostly French-speaking Protestants. Vaud joined the Confederation in 1803. The capital is Lausanne. Pop. (1930), 331,853.

VAUGHAN, Henry. British poet. He was born in Breconshire, 17th April, 1622, went to Jesus College, Oxford, in 1638, and in 1646 published his first poems, "with the tenth Satyre of Juvenal Englished." He took a medical degree, and practised at Brecon. He published pious meditations, *Silex Scintillans* in 1650-5, and in 1652 *The Mount of Olives*, devotions in prose. In 1678, *Thalia Rediviva, the Pastimes and Diversions of a Country Muse*, which consisted of elegies, translations, and religious poems, was published. He died 23rd April, 1695.

VAUGHAN - WILLIAMS, Ralph. British composer, born 12th Oct., 1872. He was educated at Charterhouse and Trinity College, Cambridge, taking his Mus.Bac. in 1894, and his Mus.Doc. in 1901. His works include *A London Symphony*, *A Sea Symphony*, as well as an opera, *Hugh the Drover* (1924), *Flos Campi* (1925), *Sir John in Love* (1929), and the ballet *Job*, notable songs, hymns, and other church music. He was a prime mover in the Leith Hill Musical Festival.

VAULT. In architecture, a concave ceiling to a building, formed by a continuous arch or a series of arches in juxtaposition, and constructed with wedge-shaped pieces of stone, brick,

or other material, so arranged that they are held together by their mutual pressure and the assistance of mortar or cement. The barrel-vault, the simplest and oldest type, gives a continuous arched roof over the whole length of an interior. It was used by the Romans, who also introduced cross-vaulting, which occurs when a series of vaults intersect the main barrel-vault at right angles. Romanesque builders developed vaulting of the semicircular kind.

In the Gothic period the evolution of the pointed arch brought a new era in vaulting, and vaulting-ribs invariably projected beyond the general surfaces of the vaults. During the fourteenth, fifteenth, and sixteenth centuries vaults increased in complexity and elaborate detail, culminating with the fan-vaulting of Tudor days. Domical vaulting is a characteristic feature of Renaissance architecture.

VAUX. A village of France, in the department of Meuse. It is celebrated for the defence of its fort, from 2nd to 7th June, 1916, during the desperate struggle for Verdun, to which Vaux formed one of the key-positions. *See* EUROPEAN WAR (section *1916 on the European Fronts*).

VAUXHALL. District of London. It is on the south or Surrey side of the river in the borough of Lambeth, and is a busy industrial district, on the Southern Railway. Vauxhall Park is an open space, and a bridge crosses the Thames here. Vauxhall Gardens was a popular pleasure resort from about 1670 until it was closed in 1859. The name is a variant of Faulkes Hall, or Fulkes Hall.

VECTOR. A directed magnitude, such as a displacement, a velocity, or a force. In three-dimensional space, two kinds of vector may be distinguished, typified respectively by a force and by the axis of a couple. The leading properties of these two types are given in the article STATICS. *See* QUATERNIONS.

VEDANTA PHILOSOPHY. A system of Brahmanic philosophy, first set forth in a work called the *Vedānta*, said to have been written more than two thousand years ago, and described as containing the quintessence of the *Vedas*. This system is based, like that of the Eleatics among the Greeks, upon the unity of all real existence. The sole real existence is denominated knowledge (*jnāna*), soul, or God. The multiplicity of individual life and variety of external life in the universe is merely phenomenal, and has all proceeded from the one real being by the exercise of the power of ignorance (*ajnāna*), which may be vanquished by a religious and ascetic mode of life, or by meditation on the one supreme spirit, Brahma, and by the extinction of all consciousness of outward things.—Cf. F. Max Müller, *Three Lectures on the Vedanta Philosophy*.

VEDAS. *Veda*, literally meaning "knowledge," denotes the collections of hymns and rituals which form the earliest scripture of the Aryans of India. They comprise (1) *Rig-veda*, "the Veda of the verses," from *rich*, "verse;" (2) *Sāma-veda*, "Veda of chant;" (3) *Yajur-veda*, "Veda of sacrificial formulæ;" and (4) *Atharva-veda*, "Veda of the Atharva priests."

(1) **Rig-veda.** This is the earliest of the *Vedas*, and probably the oldest work in any Indo-European language. It is of composite origin, including hymns by many generations and of many schools, and probably arose between 2000 and 1000 B.C., apparently in the basin of the Upper Indus and its tributaries. Originally it was transmitted orally, with extraordinary precision, among the various sākhās or schools of Vedic Brahmans; some centuries B.C. it was committed to writing. The Vedic language is related to the classical Sanskrit much as Homeric Greek is to Attic.

The Aryan society described in the *Rig-veda* is very similar to the Greek world of Homer, being composed of separate and frequently warring tribes, and the unit of society was the patriarchal household. Vedic religion—which was not identical with the popular religion—was in the hands of a class (not yet a fixed caste) of Brahmans, poet-priests who performed on behalf of householders, nobles, and kings various sacrifices and composed hymns for them.

The *Rig-veda* consists of 10 books or *mandalas*, comprising 1017 hymns (with 11 extra-canonical poems), of which most are ascribed to the seven *rishis* or seers, Gritsamada, Visvāmitra, Vāmadeva, Atri, Bharadvāja, Vasishtha, and Kanva. Most of these hymns are addressed to the chief Vedic deities: the fire-god Agni; Soma, the spirit of the intoxicating draught brewed for ritual use from the *soma* plant; the divine warrior Indra; the Asvins or twin heroes; various spirits of the sky and upper heaven, such as the wind-god Vāyu, the dawn-goddess Ushas, the sun-god Sūrya, Varuna, and Mitra, etc. There are also several philosophical hymns (in book x.), and a few poems on legends of myth, certain of which are regarded by some scholars as dramatic.

(2) **Sama-veda.** In course of time Vedic rituals, especially those of the

Soma-sacrifices, became much more elaborate. Schools of priestly specialists arose, chief being the Hotris, who recited verses of the *Rig-veda*; the Udgātris, who musically chanted them; and the Adhvaryus, who did the manual work of the sacrifice. The Udgātris were trained by being taught to chant specimen verses of the *Rig-veda* in the tunes appropriate for them; from the collections of these verses arose the *Sāma-veda*.

(3) **Yajur-veda.** The Adhvaryus accompanied their performance of the rites with formulæ, *yajus*, together with verses from *Rig-veda*, etc. These, together with some connected matter, were gathered into a corpus, the *Yajur-veda*, which has come down in five chief recensions.

(4) **Atharva-veda.** This is a collection of hymns of spells, which has come down in two recensions. The Saunakīya recension (the *Vulgate*) contains about 6000 verses, of which some 1200 are from the *Rig-veda*. The remainder, which is in both verse and prose, is mainly on a lower and more popular level than the *Rig-veda*, containing many magic charms and incantations of most diverse kind. Though much of its material is extremely ancient, and the priests professing it had much influence from early times, the *Atharva-veda* was not included until comparatively late in the orthodox Vedic Canon. To it is attached the *Gopatha-brāhmana*, a late work, and some other ancillary literature.—BIBLIOGRAPHY: F. Max Müller, *Sacred Books of the East*; M. Bloomfield, *A Vedic Concordance*; *Religion of the Veda*; A. A. Macdonell, *Vedic Mythology*; *Hymns from the Rig-veda*.

VEDDAHS. A wild, semi-savage race, about 4402 in number, residing in the interior of Ceylon, and said to be a remnant of the pre-Dravidian (proto-Australian) aborigines of Ceylon. The forest Veddahs live in trees and caves and subsist on game, which they kill with bows and arrows. The village Veddahs dwell in certain districts, but hold slight intercourse with the other inhabitants. The two tribes do not intermarry, and they have their own chiefs whom they elect and obey.—Cf. C. G. and B. Z. Seligman, *The Veddas*.

VEGA. A town of San Domingo, in the rich *Vega Real*; served by rail to Samana. It was founded in 1570, named after another town founded farther north by Columbus in 1495, and subsequently destroyed by earthquake. Pop. 14,000.

VEGA CARPIO, Felix Lope de. Spanish poet and dramatist, born in 1562, died in 1635. In 1582 he joined the army, and in 1588 accompa the Armada. After being t married and twice a widower, h 1609 became a priest, and su quently entered the order of Francis. He enjoyed an imm popularity, and is supposed to h written between 1500 and 1800 pl (*comedias*), in addition to sev hundred religious pieces (*autos*) interludes (*entremeses*). Of these th are extant over 400 *comedias* and *autos*. His dramas reveal an exhaustible but ill-regulated imagi tion, a strong mixture of the subli and the ridiculous, and extraordin facility in versification.—Cf. J. Fi maurice-Kelly, *Lope de Vega and Spanish Drama*.

VEGETARIANISM. A dietetic novation dating from about 1847. strictest followers reject all anim food; others allow the use of butt milk, and eggs, no suffering bei involved in their production; oth again go so far as to partake of n caught fish. The advantages urg for vegetarianism are: the avoidan of the taking of life, the greater fre dom of fruit and vegetables fro germs of disease, economy, and t beneficial effect of the regimen all on physical health and moral chara ter.

The oldest British vegetarian s ciety is that of Manchester; whi among the most flourishing at preser is the "fruitarian" Order of th Golden Age (headquarters, Paignto Devon), which publishes much lite ature on the subject. The impositio of "meatless days" in the Europea War, and the subsequent high price of flesh foods, have given considerabl impetus to informal vegetarianism but the consensus of scientific opinio is that man, at least in a temperat climate, requires a proportion of flesh in his diet.

VEGLIA. A Yugoslavian island i the Adriatic, 23 miles long. Pop. 22,000.

VEIN. In mining, a crack or fissure in a rock, filled up by substances different from the rock. Veins are sometimes many yards wide, having a length of many miles, and they ramify into innumerable smaller parts, often as slender as threads. Metallic veins are of very varied ages, but in the British Isles are mostly older than the Permian period.

VEINS. A system of membranous canals or tubes distributed throughout the bodies of animals for the purpose of returning the impure blood to the heart and lungs, after it has been conveyed to the various parts by the arteries. They are not elastic and

have no pulsation (thus differing from the arteries), the motion of the blood in them being mainly secured by pressure of the moving parts between which they are embedded, the backward flow of the blood being prevented where necessary by a series of valves which permit a current only towards the heart. The veins at their farthest extremities form capillaries which collect from the tissues the blood brought by the arterial capillaries. These minute branches unite to form veins, which similarly unite in turn, forming gradually larger branches and trunks as they approach the heart.

The venous blood from the head, neck, and upper limbs is all returned to the heart by one great vein, the *vena cava superior*, while that from the lower limbs and belly is returned by the *vena cava inferior*. The portal vein (*vena portæ*) receives the venous blood from the intestines and conveys it through the liver to the vena cava inferior. From each lung to the heart come two pulmonary veins carrying back the blood that has been purified in the lungs, after being carried to them by the pulmonary artery. *See* HEART.

VELASQUEZ (ve-las'keth), or, in full, **Don Diego Rodriguez da Silva y Velasquez** (or **Velazquez**). Spanish painter, born at Seville in 1599, died at Madrid in 1660. He studied first under Francisco Herrera the elder, and afterwards under Francisco Pacheco, but early came under the influence of the Naturalist school inspired by Caravaggio. His earliest work, consisting mainly of the so-called *bodegones* (eating-house) pieces, pictures of still life with figures, show the realism and desire to reproduce the visual aspect of things which inspired him all his life.

In 1622 he visited Madrid, and in 1623 was appointed painter to Philip IV., beginning the famous series of portraits of that king, of which two fine examples are in the National Gallery. Thenceforward Velasquez combined realism with increasing dignity and reticence of treatment, the qualities which give his work its distinctive character. In 1628 Rubens's visit to Madrid not only directly influenced Velasquez but led to his visiting Italy in 1629, where he especially studied Titian, Tintoretto, and Michelangelo, and formed a friendship with Ribera. In 1631 he returned to Spain. Among his paintings of the next few years are the equestrian portraits of Philip IV. and of Olivares, portraits of the queen and of Don Balthasar Carlos, the *Lady with a Fan* (Wallace Collection), *Venus Recumbent* (National Gallery), and the famous *Surrender of Breda* (Prado, Madrid).

In 1649 he again visited Italy, primarily to collect pictures for the king; and while in Rome painted the brilliant portrait of Innocent X. in the Doria Pamphili Palace, Rome. To the years after his return in 1652 belong such masterpieces as *Las Hilanderas* (The Tapestry Weavers), *Las Meniñas* (The Maids of Honour), and the portraits of Philip IV. when old.

Velasquez's influence, especially during the nineteenth century, has been immense. His later work paves the way for that of Manet and the Impressionists, in its use of light and shade to obtain a series of silhouetted forms from which his design is composed; in his feeling for tone, which enables him to fill his canvases with light and air; in his distribution of accent, so that the more important parts of his picture are emphasised and seen first; and in his use of cool and warm neutral colours as a foil to touches of positive colour. Velasquez can be well seen in all his phases in England; but his powers can only be fully appreciated in Madrid.—BIBLIOGRAPHY: Sir W. Armstrong, *The Life of Velasquez*; R. A. M. Stevenson, *Velasquez*; A. de Beruete, *Velasquez*.

VELBERT. A town of Westphalia, Germany, in the Ruhr; served by rail to Aprath, and the centre of an electric railway to Elberfeld, Werden, and Hösel. Brandy, machinery, cutlery, silk, etc., are manufactured. Pop. 20,000.

VELELLA. A curious genus of colonial cœlenterate animals, of the class Hydrozoa, order Siphonophora (q.v.), and represented by free-swimming oceanic forms, which occur around the British coasts, but more frequently in warm seas. The best-known member, *Velella spirans*, or "Sallee Man," is about 2 inches in length by 1½ inches in height. It is of a beautiful colour and semi-transparent, and floats on the surface of the sea with its vertical crest exposed to the wind as a sail.

VELEZ. An ancient city of Colombia, South America, in the department of Santander. Pop. 15,000.

VEL'EZ-MAL'AGA. An ancient city of Spain, in the province of Malaga, on the Velez. The district produces sugar-cane, the olive, the vine, sweet-potato, maize, etc. Its port is the suburb Torre del Mar, a summer bathing-place with a sugar-refinery. Pop. 23,425.

VELEZ RUBIO. A town of Spain, in the province of Almeria, in the valley of the Rio de Velez. At Fuente del Gato near by there are mineral springs. Pop. 11,500.

VELI'NO. A river of Central Italy, a left-bank tributary of the Nera, at its junction with which it forms the falls of the Marble Cascade, about 650 feet high.

VELLETRI (ancient **Velitræ**). A city of Italy, in the province of Rome. Pop. 26,000.

VELLORE. A town of Madras, India, on the Palar River. Pop. 50,210.

VENDACE. Some of the salmonoid fishes of the genus Coregŏnus. There are two British species—*C. vandesius*, inhabiting the Castle and Mill Lochs, Lochmaben (Dumfriesshire); and *C. gracilior*, native to Derwentwater and Bassenthwaite. The average length is about 6 to 7 inches. The upper parts are of a greenish-brown colour, the under parts silvery. The fish is esteemed a great delicacy, and is taken with the sweep-net about August. The species of Coregŏnus are collectively known as "whitefish." *See* GWYNIAD; POLLAN; POWAN.

VENDÉE (vän-dā). A western maritime department of France; area, 2690 sq. miles. It is watered in the north by tributaries of the Loire, and in the south by the Vendée, Lay, and tributaries of the Charente. The principal crops are grain, potatoes, beet, and hemp; and a white wine is also produced. Capital, La Roche-sur-Yon.

At the time of the Revolution the Vendéans espoused the Royalist cause, and, inspirited by La Rochejaquelein, Cathelineau, and other leaders, and aided by the hilly and wooded nature of the ground, they resisted the Republicans with varied success from 1793 to 1796, when the rising was completely quelled by the activity of General Hoche. In 1799-1800, and again in 1814 and 1815, some risings took place in favour of the Bourbons, but they were quickly suppressed. Pop. (1926), 395,602.

VENDET'TA (Italian word from Lat. *vindicta*, revenge). A blood-feud; the practice of the nearest of kin executing vengeance on the murderer of a relative. In Corsica the vendetta is regarded as a duty incumbent on the relatives of the murdered man, and, failing to reach the real murderer, they take vengeance on his relatives. The practice exists, although to a more limited extent, in Sicily, Sardinia, and Calabria, as well as among the Druses, Circassians, and Arabs.

VENDÔME (vän-dōm). A town of France, in the department of Loir-et-Cher, on the Loir. It was captured by the Prussians in the Franco-Prussian War (16th Dec., 1870). Pop. 9800.

VENEER. A thin layer of choice hard wood, such as mahogany, rosewood, maple, etc., glued to the surface of wood of a commoner sort, such as fir or pine, so as to give the whole the appearance of being made of the more valuable material. It is mostly used for furniture, and owing to modern improvements in sawing machinery, layers as thin as paper can be obtained.

Thin boards made of layers of wood, usually three in number, and cemented or glued together under pressure, are known as **plywood.** Plywood is light in weight and less liable to warp or split than ordinary boards. It is used in aeroplane construction and box manufacture, also for furniture and as panels for walls and ceilings.

VENER. A lake of central Sweden, 93 miles long; area, 2149 sq. miles. It is on the inland waterway from Göteborg to Stockholm.

VENETIA. A province of North Italy, divided into the provinces of Belluno, Padua, Rovigo, Treviso, Udine, Venetia, Verona, and Vicenza. Area, 9818 sq. miles; pop. 3,999,027. Physically it comprises a large plain with lagoon-fringed shores on the Adriatic, and merging in the Hinterland with spurs and foot-hills of the Alps, by which it is flanked. Rice is produced in Rovigo, and the raising of cereals, viticulture, and sericulture are general. Manufactures reach their highest development in the provinces of Venetia and Vicenza. Venice is the capital.

VENETIA. A *compartimento* of Venetia, North Italy. Area, 943 sq. miles; pop. (1931), 594,415.

VENETIAN ARCHITECTURE, or **VENETIAN GOTHIC.** That style of Italian architecture employed by the Venetian architects from the fifteenth to the early part of the seventeenth century. The principal characteristics are: each story is provided with its own tier of columns or pilasters, with their entablature, and separated from the other stories by conspicuous friezes or belts, often in the form of balustrades broken by pedestals and ornamented by figures; arched windows ornamented with columns, the spandrils being often filled with figures; ornamental parapets are common; and the whole has a rich and varied effect. This style

of architecture is characterised by Fergusson as "Gothic treated with an Eastern feeling, and enriched with many details borrowed from Eastern styles."

VENEZUELA (*Estados Unidos de Venezuela*). A Federal Republic of South America, comprising twenty states, two territories, and the Federal district of Caracas, the whole having an area of approximately 393,874 sq. miles; pop. (1931) estimated at 3,216,000.

States, Capitals, etc. There are upwards of 70 islands off the coast, with a total area of about 15,000 sq. miles. The departments, with their pops. (1926 census) and capitals in parentheses, are: Anzoátegui (129,791; Barcelona), Apure (58,499; San Fernando), Aragua (105,839; Maracay), Bolivar (98,258; Ciudad Bolivar), Carabobo (147,204; Valencia), Cojedes (82,152; San Carlos), Falcon (178,642; Coro), Guarico (125,282; Calabozo), Lara (271,369; Barquisimeto), Mérida (150,128; Mérida), Miranda (189,572; Ocumare), Monagas (68,765; Maturin), Nueva Esparta (69,392; La Asuncion), Portuguesa (58,721; Guanare), Sucre (216,476; Cumana), Tachira (172,900; San Cristobal), Trujillo (218,780; Trujillo), Yaracuy (122,836; San Felipe), Zamora (57,341; Barinas), Zulia (222,613; Maracaibo); territories—Amazonas (60,276; San Fernando de Atabapo) and Delta Amacuro (26,582; Tucupita); and the Federal District—Caracas (195,460). Ports include Puerto-Cabello (q.v.), the chief port of Carabobo (q.v.); La Guaira (*see* CARACAS); Carúpano; and Maracaibo (q.v.). *See* MÉRIDA; NUEVA ESPARTA; MARGARITA; PORTUGUESA; APIRE; TRUJILLO; ZULIA; ZAMORA.

Physical. There are roughly four physical divisions. The Sierra Pacaraima, which forms the frontier with Brazilian Guiana, and the Sierra Parima compose, in the main, the physical division known as the Guiana Highlands. These Highlands drain northwards to the Orinoco, and in the south to the Amazon. Roraima (8600 feet; *see* GUIANA) is the chief feature of the Sierra Pacaraima, and forms the point of convergence of the Venezuela-Brazil-British Guiana frontier.

The Venezuelan Andes form the second division, the main block of which is the Sierra Nevada de Mérida, formed by the bifurcation of the Cordillera Oriental of Colombia. Trending in a north-easterly direction, the Sierra Nevada or Cordillera de Mérida separates the Orinoco basin from that of the Gran Lago de Maracaibo and the basin of the Tocuyo and other coastal streams, and, swinging eastwards from the Rio Cojeres as the Maritime Andes, forms a self-contained double range of mountains which reach almost to the Atlantic at the Gulf of Paria. The enclosed valley between the parallel ranges is renowned for its fertility, and forms the very heart of Venezuela. Two chief divisions of the Maritime Andes are the Cordillera de la Silla (behind Caracas; 8500 feet) and the Heights of Cumana (farthest east).

The third great physical division comprises the *llanos*, vast alluvial peneplanes traversed by anastomosing rivers, and confined mainly to the region bounded by the Sierra Nevada in the west, the Orinoco in the east, and the Apure in the north. A transmontane division, embracing chiefly the department of Zulia, comprises a low-lying zone encircling the Maracaibo Lagoon, and bounded on the west by the western fork of the Cordillera Oriental of Colombia. Maracaibo Lagoon is being slowly silted up. The great hydrographic feature is, of course, the Orinoco, to the basin of which the greater part of Venezuela belongs. Venezuelan tributaries are the Caroni and Venturari, which traverse the Guiana Highlands, and the Apure (with Guarica and Portuguesa), Arauca, Meta, and Caura (*see* CASSIQUARI).

Climate. Climatically, Venezuela has several zones. On the coast the north-east trade winds blow all the year round, but are weakest in July, the rainy season. April and May are the warmest months; December and January the coolest. Up to 3000 feet altitude the temperature may be represented by La Guaira, which has a mean of 80·8° F. for the year (January, 78·4° F.; September, 82·9° F.; range, 4·5°). From 3000 to 6500 feet altitude is what is known as the "Temperate Zone," and may be represented by Caracas (3020 feet), where the mean annual temperature is 71·2° F. (January, 68·5°; May, 73·9°: range, 5·4°). At Caracas the rainfall is 31·9 inches for the year, and June, July, and October are the wettest months. In the *llanos* May to October is the wet season, and in the Mountain Zone (above 13,000 feet) the rainfall is equally distributed over the whole year. Between 6° and 8° lat. on the Sierra Mérida, the snow-line is reached at 15,000 feet. On the coastal flats and in the Orinoco delta and riverine zones the climate is very unhealthy.

Production. The chief industries are cattle-raising and the production of coffee, cacao, and sugar. About 20 per cent of the population is agrarian. Maize is the staple grain-

crop, and some cotton, tobacco, and tropical fruits are raised. In the forestal zone balatá (a notable export), rubber, copaiba, chicle (raw chewing-gum), vanilla, tonka beans, and valuable timbers are produced. Venezuela is one of the world's greatest coffee exporters, and coffee and cocoa are the chief exports (*see* PUERTO-CABELLO).

Mineral resources and products are rich and extensive. Saline thermal springs, about the hottest in the world (196°-206° F.) exist at Las Trincheras on the Puerto-Cabello-Valencia Railway. Coal is worked in the State mines at Naricual, and gold (originally from the Yurari district), copper ore (low grade), salt (a Government monopoly), petroleum (refined at San Lorenzo on Lago Maracaibo), asphalt (from Lake of Guanoco; exported to United States through the port of Cristobal Colón), and pearls (*see* MARGARITA) are among other products.

Manufactures, which are undeveloped and relatively unimportant, include cotton (the chief), cement, matches (a Government monopoly), glass, coarse paper, beer, cigars (at Caracas), leather (Caracas, Maracaibo, and Ciudad Bolivar), candles (Caracas and Maracaibo), rope, tiles (Caracas), and butter and cheese (in one factory at Maracay).

Railways.[1] *La Guaira-Caracas (3 feet), Caracas-Valencia (3 feet 6 inches), *Tucacas-Barquisimeto system (2 feet), Encontrados-Táchira (3 feet 6 inches), La Ceiba-Motatan (3 feet), *Caracas-San Francisco de Yaré (3 feet 6 inches), Carnero-La Española del Guapo (3 feet), Guanta-Barcelona and Naricual Mines (3 feet 6 inches), Santa Barbara-El Vigia (metre), Coro-La Vela (3 feet), *Valencia-Puerto-Cabello (3 feet 6 inches).

Social, etc. The State religion is Roman Catholicism, but absolute freedom is allowed. Two archbishops (of Caracas and Mérida), with seven bishops suffragan, control the State ecclesiastical organisation. Free, compulsory education, from the age of seven years to the date of completion of the elementary course, is provided, and there are universities at Caracas and Mérida (University of Los Andes). Conscription for two years is enforced upon all Venezuelans, and the reserve period covers all able-bodied men up to the age of forty-five years. There is a small naval force of three gunboats and a training-ship.

By the Constitution of 1922 the legislative authority is vested in a Congress consisting of a Senate and a Chamber of Deputies. The executive power is exercised by the President in conjunction with and acting through a Cabinet. The various states are autonomous and politically equal—each has a President and a Legislative Assembly. The Federal District and the territories are administered by governors appointed by the President of the Republic. A new constitution was adopted in 1929 and modified in 1931, which increased the president's power. This constitution is simpler and more modern in form than its predecessors. Venezuela was formed in 1830 by secession from Colombia. A long-standing boundary dispute with Colombia was settled in Colombia's favour in 1922 by the arbitration of the Federal Council of Switzerland.

BIBLIOGRAPHY: *Venezuela* (a general treatise on the laws, geography, etc., of the Republic, issued at Washington (1904) by the Bureau of American Republics); *Central and South America* (in Stanford's *Compendium of Geography and Travel*), vol. i., *South America* (by A. H. Keane); W. E. Wood, *Venezuela: Two Years on the Spanish Main*; P. F. Martin, *Through Five Republics of South America* (an historical, geographical, economic, and political summary).

[1] The gauge is given in brackets. The asterisk (*) indicates a British-owned line. All the others are Venezuelan excepting the second, which is German.

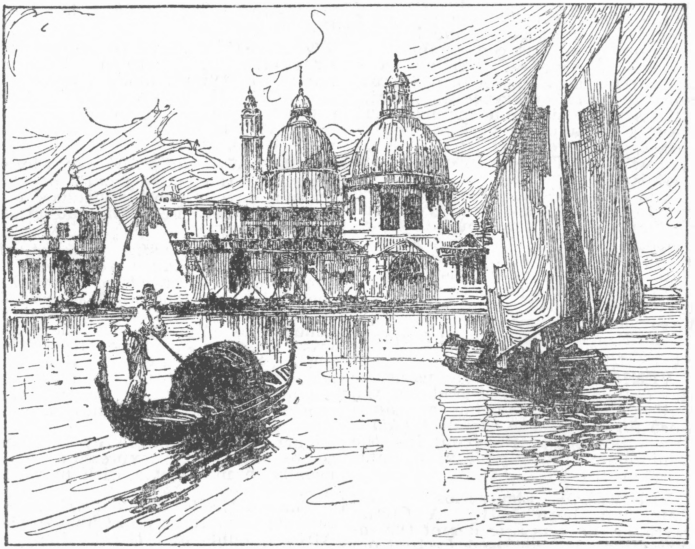
VEN'ICE (It. *Venezia*). A city and seaport of Northern Italy, capital of the province of Venezia, on a number of islets in a shallow lagoon in the north-west arm of the Adriatic (i.e. the Gulf of Venice); served by rail via Padua to Bologna (100 miles) and Milan (165 miles), via Udine to Tarvisio (148 miles), and to Trieste via Nabresina (99 miles). A long railway viaduct (the Ponte Sulla Laguna) connects the mainland with the main station of Venice (the *Stazione della Strada Ferrata*) and the adjacent *Stazione Marittima*.

The islets are very low, and the houses are mostly supported on piles. The city is divided into two parts by the Canalazzo or Grand Canal, spanned by the Rialto and lesser bridges. The numerous branch canals are crossed by over 300 bridges, which rise rapidly towards the centre to afford passage to the gondolas and other boats. The city is also intersected by *calli* or narrow lanes for pedestrians; but the canals are really the streets of Venice, and it possesses neither horses nor wheeled carriages.

Near the centre of the city there is one street about 18 feet wide, the Merceria, but the great centre of business and amusement is the Piazza, or Square of St. Mark, and the piazetta adjoining it, which faces the Canale di San Marco. The Palace of the

Doges, reconstructed by Marino Falieri in 1354, abuts on the piazetta. It contains a number of beautiful halls, some with ceilings and walls painted by Tintoretto, Paolo Veronese, and other masters. The Ponte-dei-Sospiri (Bridge of Sighs) connects the palace with the public prisons on the opposite side of a narrow canal.

The church of St. Mark (S. Marco), now the cathedral (erected 976-1071), is in the Romanesque-Byzantine style, and is surmounted by five



Venice: Church of La Salute

domes. Above the doorway are the four bronze horses brought from Constantinople by the Doge Dandolo in 1204. Other notable churches are Santa-Maria-Gloriosa-de'-Frari (thirteenth century), containing the tomb of Titian, and numerous works of art; and San Giovanni-e-Paolo, a splendid Gothic domed building.

Of the numerous palaces among the chief are the Palazzo-Reale (royal palace and library); Palazzo-Ducale (the palace of the doges), with a library and many paintings; and the Palazzo-Corner-della-Cà-Grande, the seat of municipal authorities. The remaining public buildings include the Accademia delle Belli Arti, containing works by Titian, Giorgione, Tintoretto, Paolo Veronese, and others; the Dogano, or custom-house; the arsenal; and the Zecca, or mint.

The chief manufactures are woollen cloth, cloth of gold and silver, velvet, lace, ornamental and coloured glass, mosaic, jewellery, and castings. The trade is extensive; the imports include colonial goods, dye-woods, coal, iron, and oil; exports, timber, rice, linen, glass, coral, etc. The harbour is spacious, but the entrances are shallow. Pop. (1931), 260,247.

Venice is supposed to have been founded in the fifth century by inhabitants of the surrounding districts, who took refuge from the cruelty of Attila on the islets at the mouth of the Brenta. In 697 Pauluccio Anafesto was elected the first doge or duke, and in 819 the seat of government was removed from Malamocco to Rivoalto (Rialto), and the adjacent islands were connected by bridges.

The Crusades (1096 to 1271) greatly increased the wealth and power of the Venetians by giving employment to their shipping. In 1204 the Doge Enrico Dandolo conquered Constantinople, and upon the division of the Byzantine Empire Venice received a large accession of territory. Under Dandolo's successors the Venetians

gradually lost all their mainland possessions. But in 1386 they captured Corfu, Durazzo, Argos, etc.; in 1405 their general, Malatesta, conquered Vicenza, Belluni, Verona, and Padua; and besides these and other conquests on land, the Venetian fleet defeated the Turkish at Gallipoli in 1416, and in 1421 subjugated all the towns along the Dalmatian coast.

At the close of the fifteenth century Venice had a population of 200,000, and was the centre of the entire commerce of Europe. Its power then began to decline, its commerce was gradually superseded by that of the Portuguese, and in 1508 a league to subdue the republic was formed at Cambrai between Pope Julius II., the Emperor of Germany, and the kings of France and Spain. All its possessions on the mainland were taken, and the work of destruction was all but completed by warfare with the Turks at intervals from 1649 to 1718.

The French took possession of the city in 1797. It subsequently became part of the Austrian Empire, of Napoleon's kingdom of Italy, and from 1815 to 1866 of the Lombardo-Venetian Kingdom under Austria. In 1866 the city and province was ceded to Napoleon III., under whose auspices they were united by a plebiscite to the Kingdom of Italy.—Cf. Smith, *The Seven Ages of Venice*.

VENICE LIDO. Popular name for the seaboard of the islands in the Gulf of Venice, *Lido* being the Italian word for *shore*. The island of *Lido* is five miles long, and contains the fashionable watering-place of Sant' Elisabetta.

VENIZELOS, Eleutherios. Greek statesman, born 1864. A Cretan barrister, he was a leader of the insurrection that released Crete from the Turkish yoke (1897), and was elected for Athens to the Greek Assembly (1910). From 1910 to the present day he has been the dominant figure in Greek politics. He founded the Balkan League (1912), and in 1914 (European War) was pro-Entente: but his proposals for war, though supported by the electorate, were vetoed by King Constantine.

In 1916 he founded a revolutionary Provisional Government in Crete, and on the dethronement of Constantine by Britain and the succession of Alexander, Venizelos returned to Athens (1917), reorganised the Government, and declared war against the Central Powers. He represented Greece at the Peace Conference, but was rejected at the elections of Nov., 1920. He was Premier for a short time in 1924, and was again appointed in 1928. On this occasion he held office until in 1932 the elections swept away his majority, giving his party no more than 100 seats out of 250, and a coalition government was formed. *See* GREECE, *History*.

VENLO. A town of the Netherlands, province of Limburg, on the Meuse. Pop. (1932), 25,052.

VENTIMIGLIA. A town of Italy in the province of Porto Maurizio and in the Riviera di Ponente; served by the coastal railway (Marseilles–Genoa) and to Cuneo (*see* PORTO MAURIZIO). Pop. 8000 (commune, 16,000).

VENTNOR. A watering-place of England, on the south-east shore of the Isle of Wight, in the district of Undercliff. It has a hospital for consumptives, and a seaside home. There is a good beach for bathing. Pop. (1931), 5112.

VENTOSE (literally, "windy month"), the sixth month of the French Revolutionary Calendar, beginning on 19th Feb., and ending on 20th March.

VENTRIL'OQUISM. The art of appearing to produce vocal sounds from some source other than the speaker's lips. The word is derived from *venter*, owing to the mistaken belief of the Romans that the belly was the seat of such production. The illusion is effected by permitting only a slow escape of the breath; by narrowing the glottis, opening the mouth but slightly, and moving only the tip of the tongue; also by engaging the attention of the audience to by-play, facial expression, and, usually, a marionette with movable lips.

The practice is of wide distribution, ranging from India and China to the African Zulus and the Eskimos of the North. It was known to the Egyptians, Hebrews, and Greeks; and it is highly probable that the supposed miraculous utterances emitted by the oracles of Greece, with other wonders of like nature, were produced by means of ventriloquism by the priests and skilled practitioners.

VE'NUS. The Roman name of the goddess of love, called by the Greeks Aphroditē. In the *Iliad* she is described as the daughter of Zeus and Diōnē; but Hesiod represents her as the offspring of Urānus, born among the foam (Gr. *aphros*) of the sea. She surpassed all other goddesses in beauty, and hence received the apple which was to be awarded to the most beautiful by Paris. She was the wife of Hephæstos (Vulcan), but also bestowed her love on the gods Arēs

(Mars), Dionysos (Bacchus), Hermes (Mercury), and Poseidon (Neptune), and the mortals Anchises and Adonis. The myrtle, rose, poppy, apple, and other fruits were sacred to her, as were also the dove, sparrow, swan, swallow, ram, hare, and tortoise.

The chief places of her worship in Greece were the Islands of Cyprus and Cythera. In Rome several temples were erected to her under different names. In the best days of art this goddess was always represented draped, in later times nude. The scene of her arising from the sea was sculptured by Phidias on the base of the statue of Zeus at Olympia, and one of the most famous pictures of Apelles represented the same subject. The Venus of Capua and the Venus of Milo represent her as Venus Victrix, with one foot on a helmet and raising a shield.

The Venus de' Medici is supposed to be a free copy of a statue of her by Praxiteles, which was celebrated above all her other statues in ancient times. Among modern statues of Venus, one of the most famous is that by Canova, which represents her as issuing from the bath.—Cf. L. R. Farnell, *The Cults of the Greek States*.

VENUS. One of the inferior planets, having her orbit between those of Mercury and the earth (*see* PLANET). Her diameter is 7600 miles, and her volume about 0·88 of the earth's, but her density being slightly less her mass is equal to about 0·83 of the earth's. Venus is the most brilliant of all the planetary bodies. When west of the sun she is seen as morning star, when east as evening star. Hence she gained the designations of *Lucifer* and *Hesperus*, and some ancient peoples believed the appearances to be really of different objects.

According to her various positions relatively to the sun and earth, she exhibits phases like the moon. Though a beautiful object in the telescope, the dazzling brightness of the disc of Venus, probably due to the high reflective power of a cloudy atmosphere, renders it difficult to discern clearly any surface detail. It was long supposed that the planet rotated in about 23¼ hours. Some astronomers now think that the period is 225 days, identical with that of revolution. *See* TRANSIT.

VERA CRUZ. A maritime state of Mexico; area, 27,880 sq. miles; pop. (1930), 1,376,865 (after Jalisco, the state with the largest population in Mexico). Physically considered, it rises from a lagoon-fringed, alluvial, coastal zone, through the submontane region of the Sierra Madre Oriental, to merge in the Mexican Plateau, and includes within its boundaries the peak of Orizaba (18,300 feet). In the south of the state, on the coast, is the volcano of Tuxtla (4920 feet).

The climate varies from the heat, and unhealthy humidity, of the coastal steppe, through every gradation to the cold dryness of the everlasting snows on Orizaba and the Cofre de Perote (13,400 feet).

Sugar and rum are the chief products, with coffee not far behind; but many other important commodities are raised, such as cotton, vanilla, maize, and various fruits. Cattle and horses are bred here and there, and there is a large forestal industry, and some mining activity. Jalapa is the capital; other towns are Vera Cruz*, Tuxpan*, Puerto Mexico (or Coatzacoalcos)*, Nautla*, Alvarado*, Orizaba, and Cordobas. The asterisk indicates a port.

VERA CRUZ. A city and the chief seaport of Mexico, in the state of Vera Cruz; served by four railways (two to Mexico City). There is a large foundry, and tobacco is manufactured. Pop. (1930), 70,000.

Founded by Cortes in 1520, the city was removed in 1599 to its present site on the low coastal flats, and has since been sacked by privateers (1653 and 1712), captured by the French (1838), by United States troops (1847), again by the French (1861), who made it their head-quarters during the campaign of 1862-7, and in 1914 by the United States. The fort of San Juan de Ulloa, first built after the privateers had raided the city, is the key to the place. It occupies one of the coralline reefs that protect the harbour, and its fall has always left Vera Cruz at the mercy of the victor.

VERAT'RIN, or **VERAT'RIA.** *See Veratrum.*

VERAT'RUM. A well-known genus of plants belonging to the nat. ord. Liliaceæ. *Veratrum album* (common white hellebore) is a native of most alpine meadows in the southern, central, and northern parts of Europe. It has large plaited leaves, erect stems, and large panicles of greenish flowers. It yields the substance veratrin, used as an external application in cases of neuralgia.

VERBE'NA. A genus of plants, the type of the nat. ord. Verbenaceæ. Most of the species are American; about seventy are enumerated. *V. officinālis* (common vervain), a plant common in England, and widely distributed, was once held in great repute for its medicinal virtues. Several species are cultivated for the great beauty of their flowers, being fine

border plants. The verbena of the perfumers is the lemon-grass, from which the "oil of verbena" is extracted.

VERBENA'CEÆ. A natural order of plants, consisting of trees, shrubs, and herbaceous plants common in the tropics of both hemispheres, but rare in Europe, Asia, and North America. They have generally opposite or whorled simple or compound leaves without stipules; flowers in opposite corymbs, or spiked alternately, sometimes in dense heads, seldom axillary or solitary. The verbena and teak are examples.

VERCELLI (ver-chel'lē). A town of Piedmont, North Italy, department of Verulli, on the Sesia. It has a seventeenth-century cathedral, a castle (now converted into courts of justice), hospital, cavalry barracks, etc., flourishing manufactures and trade. The Gothic church of Sant' Andrea dates from 1219. In 101 B.C. Marius defeated the Cimbri at Vercelli. Pop. (1931), 39,546. The department has an area of 1157 sq. miles, and a pop. of (1931), 359,525.

VERD-ANTIQUE. In mineralogy, an aggregate of serpentine and white marble, having a general greenish colour. It is beautifully mottled, takes a fine polish, and is much used for ornamental purposes. *Oriental Verd-antique* is a green porphyry used as an ornamental stone.

VERDEN. A town of Hanover, Prussia, on the Aller, near its confluence with the Weser. It has manufactures of cigars. Pop. 10,073.

VERDI, Giuseppe. The greatest Italian opera composer of the nineteenth century, born at Roncole, near Busseto, Parma, on 10th Oct., 1813, died 1901. At the age of seven he became a pupil of the local organist, and three years later succeeded his master as organist. He was sent to school for two years at Busseto, at that time a musical centre, and Barezzi, the president and patron of the local philharmonic society, and Provesi, the conductor, were greatly interested in Verdi.

When sixteen he was sent to Milan, where he studied under Lavigna. In 1833 he went back to Busseto, but returned to Milan in 1838, when the opera *Oberto* was produced at La Scala with considerable success. The opera *Nabucco* was produced in 1842, and between then and 1871 Verdi produced twenty-three operas, not all of which were successful.

Among his most popular works are: *Rigoletto* (1851), *Il Trovatore* and *La Traviata* (1853), *Un Ballo in Maschera* (1859), *La Forza del Destino* (1862), and *Aïda* (1871). *Otello* (1887) *Falstaff* (1893), a remarkable p of work for a man of eighty, among his greatest works. Of r operatic music, his *Requiem* is only classic.

VER'DIGRIS. A poisonous s stance, prepared by exposing cop to the air in contact with acetic a and used as a pigment, as a mord and in medicine. The name is s popularly given to copper rust, green or bluish substance formed the action of carbon dioxide on cop in the presence of water; this i basic carbonate, of the same co position as malachite.

VERDUN (ancient **Verodonu** A town of France, on the Meu forming a first-class fortress and r way node; a junction on the lin Châlons-Conflans and Lerouville-S dan, for the branch line Verdun-B le-Duc. It is famous for its manuf tures of *dragées* (sugar-plums) a preserves, but has tanning, flou milling, brewing, and other industri as well as a large trade in cerea wood, wine, etc.

During the European War Verdu figured prominently as the core French resistance (*see* EUROPE: WAR, sections *1916 on the Europea Fronts* and *French Front in the We 1917*). Pop. 16,540.

There are two other French town of note: **Verdun,** in Tarn-et-Garonne pop. 3500; and **Verdun** (*Sur-l Doubs*), ancient *Verdunum Castrun* in Saône-et-Loire, at the confluence o the Saône and Doubs; served by th Chagny-Dôle branch of the P.L.M Railway, via Allerey; pop. 2000.

VERHAEREN, Émile. Belgia poet, born in 1855, killed when at tempting to enter a moving train a Rouen in 1916. Educated at Ghen and at Louvain, he founded *La Semaine* and became the leader o the literary group known as Youn Belgium (*La Jeune Belgique*). Ver haeren was an impressionist, and his poetry is distinguished by vividness imagery, and dramatic intensity. His works include: *Les Flamandes* (1883), *Les Moines* (1886), *Les Soirs* (1887), *Au bord de la route* (1890), *Les Villages illusoires* (1894), *Les Visages de la vie* (1894), *Les Forces tumultueuses* (1902), and the series *Toute la Flandre* (1904-11). In 1914 appeared his *Belgique Sanglante*, dealing with the German invasion of his native country.

VERKHOYANSK. A town of Siberia, in the government of Yakutsk It has the doubtful distinction of being the coldest place in the world, and the place with the greatest range of temperature on earth—over 100°. The

n temperature in January is)° F.; but the average lowest tem- ıture of that month is −83°, and)°, the lowest reading ever taken the surface of the earth, was re- led in Verkhoyansk in Feb., 1892. highest January temperature ever)rded in Verkhoyansk was −13° In July the mean is 60°, and the olute maximum 90° F. The rain- is exceedingly small, only 3·9 hes for the year, according to ndrew.

/ERLAINE, Paul. French poet of) Symbolist school, belonging to)se known as the Decadents, born 44, died 1896. Inspired by Baude- re, he published in 1865 his *Poèmes turniens*, which were followed in 69 by *Les Fêtes galantes*. In 1870 went into exile, and returned an mirer of Catholicism, to which ystic tendencies had led him. This w spirit is reflected in his work *ngesse* (1881).

He visited England and finally ttled in Paris, where he passed the maining years of his disorderly life, inking absinthe and sojourning equently in prisons and hospitals. mong his works are: *Romances ns paroles* (1887), *Parallèlement* 890), *Bonheur* (1891), *Mes hôpitaux* 891), *Confessions* (1895), and *Chair*.

A master of verse, Verlaine invented ew forms in French poetry, and his erse is lyrical, fluid, and magical. It , however, somewhat of an exag- eration to compare him to Shelley, s A. Symons (*Colour Studies in Paris*) has done.—Cf. E. Lepelletier, *Paul Verlaine: sa vie, son œuvre*.

VERMEJO (ver-mā′hō), or **RIO GRANDE.** A river of Argentina, rises n the highlands of Bolivia, and flows n a south-easterly direction to join the Paraguay; length, 1800 miles.

VERMONT. An inland state in the New England division of the United States, deriving its name from the Green Mountains (*Vert mont*), a chain traversing it almost centrally from north to south (Mount Mansfield, 4400 feet), and forming a watershed between the streams running eastwards to the Connecticut River (the boundary with New Hampshire) and those flowing in a westerly direction to either Lake Champlain (q.v.) or the Hudson River.

Physical. The state forms part of the uplands of New England, and has an average height of 1000 feet; but it is considerably lower in the north-west, abutting Lake Champlain, and the only navigable streams (Missisquoi, Otter Creek, Lamoille, etc.) are found there. Otter Creek is of greatest economic importance. Elsewhere the rivers are more or less swift, and are harnessed for power to drive sawmills and run the machinery used in the making of wood-pulp.

Towns. Montpelier is the state capital, but Burlington (q.v.), a port of entry on Lake Champlain, is the largest city and the commercial capital. Other cities are Rutland (17,315), Barre (11,307), and St. Albans (q.v.).

Communications. In 1932 there were 1191 miles of steam and 16·48 miles of electric railways in Vermont, the chief lines being the Boston & Maine, Central Vermont, and the Rutland Railway (New York Central system).

Social. About 12 per cent of the population is foreign born, Scots numbering 1454, English 1929, and Irish 1806 (approximately). English and French Canadians together make up 30·1 per cent of the foreign-born population. The Roman Catholic religion predominates, with Congregational second and Methodist third.

Production and Industry. Agriculture is the chief industry, and over 50 per cent of the population is rural. Hay is the chief crop, followed by cereals of all kinds, potatoes, and apples. There is a tendency towards intensive development of dairying and live-stock, and, at the moment, Vermont is a leading butter producer, with a first-class record in economical methods of production, etc. Manufactures include cotton, flour, and machinery. About half of the marble of the United States is produced in Vermont (chiefly at Pittsford, Proctor, and West Rutland).

Education, etc. Education is compulsory between the ages of eight and sixteen years, and there are three universities (Vermont, Norwich, Middlebury). Area, 9564 sq. miles (440 miles being water); pop. (1930), 359,611 (including 568 negroes).

Constitution. Vermont became a state of the Union in 1791. There are 14 counties. The Legislature is bicameral, comprising a Senate (30 members) and a House of Representatives (248 members), 2 Senators and 1 Representative being sent to Congress.—BIBLIOGRAPHY: E. D. Collins, *History of Vermont*; E. Conant, *Geography, History, and Civil Government of Vermont*.

VERNE (vern), **Jules.** French author, born at Nantes 1828, died 1905. He studied law, but afterwards began writing short pieces for the stage. In 1863 he published *Five Weeks in a Balloon*, and the vein of the marvellous, tinged with a quasi-scientific realism, was henceforth worked by him with great success. His more popular works are: *Twenty*

Thousand Leagues under the Sea, *From the Earth to the Moon*, *Round the World in Eighty Days*, and *A Journey to the Centre of the Earth*. Most of his works have been translated into English.

VERO'NA. A city of Venetia, North Italy, capital of the province of Verona, on the Adige. There is a Roman amphitheatre, supposed to have been built about the second or third century A.D., the interior of which is nearly perfect; an imposing fourteenth-century cathedral in the Gothic style; and many other magnificent churches rich in art treasures. Other notable edifices are the Palazzo del Consiglio, adorned with statues of celebrated natives of the town; and the Gothic tombs of the Della Scala family (Scaligeri), who ruled Verona from 1262 to 1389.

The town has manufactures of silks, woollens, hats, etc., and a considerable trade. Verona was subject to the Romans in the second century B.C., and on the decline of the Roman Empire it was taken by the Goths, and became the capital of Theodoric's empire.

In 774 it was captured by Charlemagne, and subsequently became an independent republic. Weary of the dissensions of its nobles, it voluntarily ceded itself to Venice, under which it remained from 1405 to 1797. It then passed to the Austrians, under whom it was till 1866. In that year, however, it became Italian. Pop. (commune, 1931), 153,923. The department has an area of 1195 sq. miles; pop. (1931), 563,159.

VERONAL. A trade name for *malo-urea*, ($C_8H_{12}N_2O_3$), a white, soluble, crystalline powder, useful as a hypnotic in nervous insomnia and in insomnia associated with disease of the heart.

VERONESE (vā-ro-nā'ze), **Paul.** The name usually given to Paolo Cagliari, an Italian painter, born at Verona in 1528, died at Venice 1588. He studied at Verona under his uncle, Antonio Badile, and Brusasorci; visited Mantua to work for Cardinal Gonzaga in 1547; and in 1555 settled in Venice. Here his early work won him immediate success. In 1560 he was commissioned to decorate in fresco the Villa Barbaro at Maser; and in 1562 produced the great *Feast of Cana*, now in the Louvre.

In 1564 he visited Rome, and on his return to Venice was engaged to decorate the Ducal Palace. The fire of 1577 destroyed much of his work; but he was commissioned to paint a new series, of which the *Battle of Lepanto* (Academy, Venice) is the best-known example. In 1573 finished *The Feast in the Hous Levi* (also in the Academy), the troduction into which of Ger soldiery, buffoons, and a parrot to his trial before the Inquisitior a charge of irreligion. This in no affected his reputation, and he busily engaged until his death.

This last period is represented the admirable examples of his w in the National Gallery, including *Feast of Darius* and four *Allegor* Conventional and artificial, his w is nevertheless redeemed by his b liant handling, decorative designs, a splendour of colour.

VERON'ICA, SAINT. A fem saint who, according to legend, n our Saviour bending under the weig of the cross, and offered Him her v to wipe the sweat from His bro when the divine features were fou miraculously impressed on the clot This veil was brought from Palesti to Rome, where it is still preserv by the canons of St. Peter's.

VERRALL, Arthur Woollgar. En lish classical scholar, born in 185 died in 1912. He was educated Wellington and at Trinity Colleg Cambridge. He graduated as secon classic in 1873, and was brackete First Chancellor's Medallist with H. Butcher and T. E. Page, th being the only occasion on whic three medals were awarded. Verra was called to the Bar in 1877, and i the same year became a member c the staff of his college.

He published a brilliant edition o the *Oresteia* of Æschylus; but hi services to Euripides were even mor notable, including editions of th *Medea* and the *Ion*, and discursiv works such as *Euripides the Rational ist* and *Four Plays of Euripides* The work of Verrall did much to rehabilitate Euripides after the attacks of Niebuhr, Schlegel, and Swinburne.

Verrall had a great gift for distilling new ideas from old material which had been handled by countless predecessors. As a lecturer he was eloquent and persuasive; and though he was himself a "pure scholar" of the old school, his vigorous mind and his keen sense of humour brought a current of fresh air into lecture-rooms too long hermetically sealed by an out-worn Porsonian tradition. For fifteen years he heroically endured an illness which crippled him. Some sixteen months before his death he was appointed the first King Edward VII. professor of English literature at Cambridge.—Cf. M. A. Bayfield, *Memoir* in Verrall's *Collected Literary Essays, Classical and Modern.*

VERSAILLES. A town of France, capital of the department of Seine-et-Oise; served by trams to Saint Cyr-Maule, etc., by the main line to Bordeaux, by the Grande Ceinture Railway, by frequent services from Paris (St. Lazare, Montparnasse or Invalides), and from Mantes (via Plaisir Guignon). It is regarded as one of the handsomest towns in Europe, having been built under the auspices of the sovereigns of France, particularly Louis XIV., who made it the seat of his court, and erected the palace.

This is a large and imposing building with an extensive park and gardens, fine fountains, etc. Louis Philippe converted the palace into a national museum, and it contains an immense collection of statues and paintings representing personages and events connected with the French monarchy from Clovis downwards.

In Oct., 1870, the Germans established their headquarters at Versailles; from March 1871 till 1879 it was the seat of the French Government; and on 28th June, 1919, there was completed and signed in the Galerie des Glaces of the famous palace (the same room in which William I. was crowned German Emperor in 1871), the Treaty of Versailles which marked the conclusion of the European War. Pop. (1931), 66,859.

VERSAILLES, TREATY OF, by which the European War was brought formally to a close, was signed on 28th June, 1919, between Germany and the Allied and Associated Powers, which included the British Empire, the United States of America, France, Italy, Japan, Belgium, Bolivia, Brazil, China, Cuba, Czechoslovakia, Ecuador, Greece, Guatemala, Haiti, Hejaz, Honduras, Liberia, Nicaragua, Panama, Peru, Poland, Portugal, Rumania, Siam, Uruguay, and Yugoslavia.

In brief, the main provisions of the treaty were: (1) It marked the end of the war, though the official termination was not till 31st Aug., 1921, when all the Governments represented by the respective signatories had ratified the treaty. (2) It instituted the League of Nations, and in it was embodied the Covenant of the League. (3) The boundaries between Germany and neighbouring states were delimited: Alsace-Lorraine was restored to France; the Saar Valley (q.v.) went to France; Eupen, Malmédy, and Moresnet were ceded to Belgium; Danzig (q.v.) became a Free City; Memel (q.v.) passed under the control of the Conference of Ambassadors (in 1923 it was given to Lithuania); Posen District, etc., was ceded to Poland, thus separating East Prussia from the rest of Germany; and part of Upper Silesia went to Czechoslovakia. (4) Plebiscites were arranged to be held in Schleswig (Slesvig), East Prussia, and Silesia. (5) Germany recognised the independence of Luxembourg, Austria, Czechoslovakia, Poland, and the Baltic States. (6) The Kiel Canal was internationalised, and the limits of international navigation on the Oder, Niemen, Elbe, and Danube were fixed. (7) A large zone all along the western boundary of Germany was demilitarised permanently. (8) Provision was made for the Allied occupation of the area between the Rhine, Holland, Belgium, and France, this area being bounded on the east by a neutral zone. (9) Germany renounced all claim to her former colonial and other foreign possessions (*see* MANDATED TERRITORIES). (10) Shantung, including Kiaochow, was ceded to Japan (*see* WASHINGTON CONFERENCE). (11) Germany renounced all claims to or interests in Egypt, Siam, Liberia, Morocco, China, Turkey, Bulgaria, etc. (12) Regulations were made regarding the German army (100,000 men), navy (6 battleships, 6 light cruisers, 12 destroyers), air-force (none permitted), and fortifications. (13) Various financial and economic clauses were included. (14) Provision was made for the payment by Germany to the Allies of reparation in money and in kind (including the cost of the war)—total value *c.* £20,000,000,000, payable by 1958. (15) Regulations were framed regarding German railways, waterways, ports, etc. There were also signed at the same time various security treaties providing for action in the event of unprovoked aggression on or by Germany. **Important Note.**—It is of the utmost importance to consult in connection with this article the various articles cross-referred to, the articles on places mentioned, and also LOCARNO, GERMANY, RUHR, SAAR, LEAGUE OF NATIONS.

VERSE. A measured and cadenced form of speech or composition, usually adopted in poetry. Grammarians have elaborately classified the varieties of verse, and analytically distinguished the possible divisions of words into bars of accented and unaccented syllables. (*See* RHYTHM.) The term is also applied to a line of poetry consisting of a certain number of metrical feet disposed according to the rules of the species of poetry which the author intends to compose. *See* BLANK VERSE; ALEXANDRINE.

VERTEBRA'TA (Chordata). A phylum of the animal kingdom distinguished by the possession of (1) a central nervous system in the form of a dorsal tube; (2) an elastic skeletal rod, the *notochord*, underlying this; and (3) gill slits. In adults the notochord is usually wholly or partly replaced by a vertebral column, and the gill slits may have closed.

There are four sub-phyla: (1) Hemichorda. Notochord small, and limited to the anterior part of the body. The worm-like Balanoglossus and two other unfamiliar marine forms are here included. (2) Cephalochorda. The lancelet (Amphioxus). (3) Urochorda. The degenerate ascidians or tunicata (q.v.). (4) Craniata. This embraces all the remaining vertebrates, which possess a distinct brain and skull.

Divided into six classes: (i) Cyclostomata. Eel-shaped animals with suctorial mouths, devoid of limbs and jaws; lampreys and hags. The remaining five classes include jawed animals, that usually possess two pairs of limbs. (ii) Pisces. Fishes. (iii) Amphibia. Frogs, salamanders, etc. (iv) Reptilia. Reptiles. (v) Aves. Birds. (vi) Mammalia. Mammals. *See* separate articles.

VERTICILLIUM. A genus of Fungi Imperfecti, section Hyphomycetes. *V. albo-atrum* attacks the potato-plant, choking up the wood-vessels of the stem and causing the haulm to die prematurely, thus reducing the yield of tubers.

VERTUE, George. English engraver, born in Westminster in 1684, died in 1756. He enjoyed the patronage of Sir Godfrey Kneller, and became engraver to the Society of Antiquaries in 1717. His best-known works include twelve portraits of poets and ten portraits of Charles I. and his friends.

VERVIERS. A town of Belgium, in the province of Liége, on the Vesdre. It is celebrated for its manufacture of broad-cloth and woollen yarn, the staple of the town. There are also machinery, leather, and other manufactures. Pop. (1931), 44,022.

VESOUL. A town of France, capital of the department of Haute-Saône, on the Durgeon, an affluent of the Saône; served by the great trunk line Boulogne-Trieste, via Laon, etc., on which it is an important junction. There are vineyards in the vicinity, and furniture, etc., is made. Pop. 10,859.

VESPASIA'NUS, Titus Flavius. Emperor of Rome, born near Reate, in the country of the Sabines, in A.D. 9, died in 79. After serving with distinction in Germany and in Brita as commander of a legion, he w made consul. He afterwards becar proconsul of Africa, and on the r bellion of the Jews he was sent wi an army into Judæa (A.D. 66). Ve pasian reduced nearly all Galilee, ar was preparing to attack Jerusale when he received news of Nero death (A.D. 68).

Then followed the emperors Galb Otho, and Vitellius, and in A.D. 6 Vespasian was himself elected en peror by the army, and arrived i Rome about the middle of the yea 70, leaving the siege of Jerusalen to his son Titus. He immediately re formed the discipline of the army purified the senatorial and equestria orders, and improved the administra tion of justice. He also rebuilt a par of the city, restored the capitol, an erected the gigantic amphitheatre the ruins of which are still celebrate under the name of the *Colosseum*.

VESTA. In Roman mythology, th goddess of the hearth. She was wor shipped, along with the Penates, at every family meal, when the house hold assembled round the hearth, which was in the centre of the room. Her public sanctuary was in the Forum, and the sacred fire was kept continually burning in it by the vestals, her priestesses.

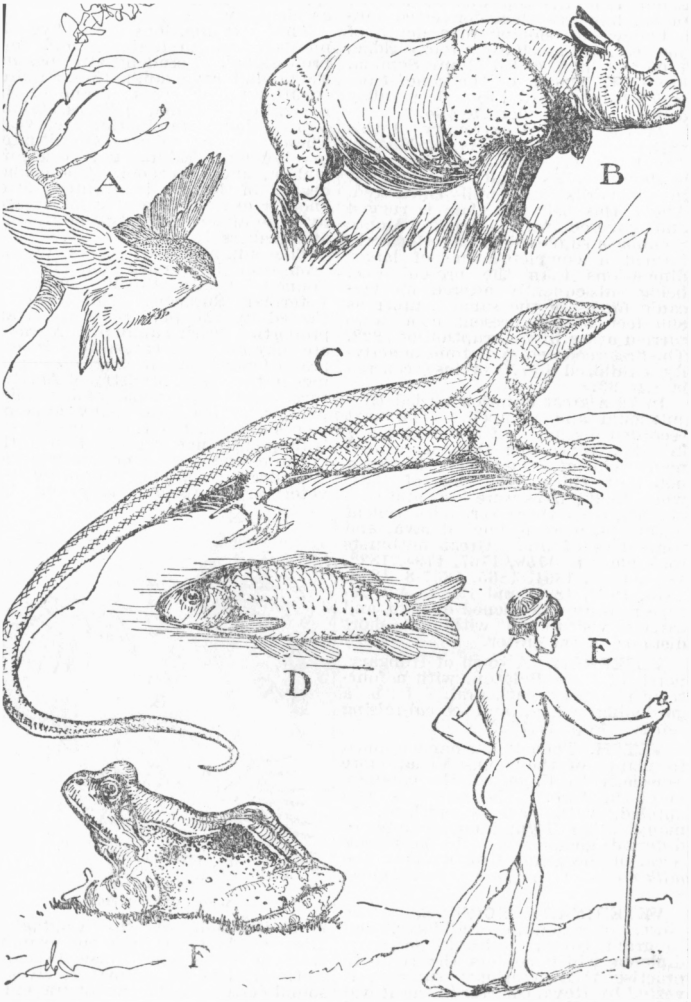
The vestal virgins are said to have been established by Numa. There were at first four, and afterwards six of them. They were taken from six to ten years of age. They were bound to virginity for thirty years, the term of their service, after which they were allowed to marry. Their persons were inviolable, and they were treated with great honour, and had important public privileges. The punishment of a vestal who broke her vow of chastity was burying alive. Theodosius abolished the vestal virgins in A.D. 394. —Cf. W. W. Fowler, *Roman Festivals*.

VEST-AGDER. A southern, maritime *fylke* or county of Norway. Area, 2793·8 sq. miles; pop. (1930), 81,233.

VESTERAALEN. A large archipelago lying off the north-west coast of Norway, 3° within the Arctic Circle; separated from the Lofoden Islands by the Raftsund. The largest island is Hindö.

VESTFOLD. A southern, maritime *fylke* or county of Norway, with a seaboard on Oslo Fjord. Area, 903·2 sq. miles; pop. (1930), 134,107.

VESUVIUS. A volcanic mountain of Southern Italy, 10 miles E.S.E. of Naples. It rises in the centre of a plain 2300 feet above the sea, in a pyramidal cone of about 1900 feet; total height, over 4000 feet, liable to



VERTEBRATES

A, Bird. B, Mammal, Rhinoceros. C, Lizard. D, Fish. E, Man. F, Frog.

alteration at eruptions. The cone is truncated, and about 2000 feet in diameter. Previous to an eruption about 1838 the top was an uneven plane, but was then converted into a hollow cup sloping to a depth of 500 feet. A precipitous rocky ridge, 1400 feet high, called Monte Somma, lies to the north of the cone, from which it is separated by a deep valley called the Atrio del Cavallo.

At the western extremity of this valley an observatory is established. The lower belt of the sloping plain is about 2 miles broad; it is laid out in vineyards and well cultivated. Above this belt the plain is rugged and covered with scoriæ. Monte Somma is supposed to have formerly formed a complete cone of larger dimensions than the present one, being subsequently altered by volcanic forces in the same manner as 800 feet of the present cone were carried away by an eruption of 1822. The first recorded symptoms of activity exhibited by Vesuvius occurred in A.D. 63.

In 79 a great eruption buried Herculaneum and Pompeii. The next recorded discharge of liquid lava was in 1036. Since then there have been many violent eruptions, the most noted of which were that of 1631, when 18,000 lives were lost, and that of 1906, when there were most violent outbursts, a great flow of lava, and some loss of life. Great outbursts took place in 1759, 1767, 1794, 1822, 1855, 1858, 1861, 1865, 1867-8, 1872, 1878, 1880, 1895, and 1906. A wire-rope railway was opened in 1880, and carries visitors to within a short distance of the crater.

VESZPRÉM. A town of Hungary, north of Lake Balaton, with a fourteenth-century cathedral. It is a gardening, wine-, and cereal-raising centre. Pop. 17,492.

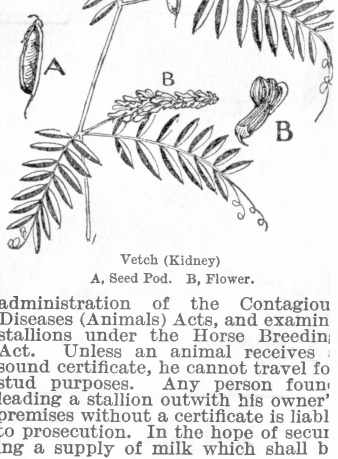
VETCH. The popular name applied to plants of the genus Vicia, more especially to *V. sativa*, the common vetch or tare. The name is also applied, with various epithets, to many other leguminous plants of different genera: as, the *horse-shoe vetch*, of the genus Hippocrēpis; the *milk-vetch*, of the genus Astragălus; etc.

VETERINARY SCIENCE. The power to examine candidates, and to grant to any suitable person a diploma which confers the right to practise as a veterinary surgeon, is vested by Royal Charter in the Royal College of Veterinary Surgeons, and no one can legally use the title veterinary surgeon unless he be a Member of the College. This body does no teaching, but attends to all matters affecting the interests of the profe sion, and elects the examiners, wh may be veterinary surgeons, specialists in certain subjects, suc as chemistry.

The examinations are five number, one preliminary and fou professional. A student, after passin the preliminary examination, require to attend four years at one of th recognised teaching colleges, takin a professional examination each yea These teaching colleges are situate in London, Edinburgh, Glasgow Dublin, and Liverpool. The highe degree of Fellow is granted, afte another examination at a later date to those already holding the diplom of membership.

The administrative work of th profession is carried out by th Council of the Royal College o Veterinary Surgeons. This council i elected by the profession, a certain proportion retiring annually. A gradu ate may choose a career as a genera practitioner; but there are also open ings in the army, Ministry of Agricul ture, county councils, and municipalities. There are many appoint ments abroad, but the salary offered is frequently not in proportion to th expenses and inconveniences incurred

Under the Agricultural authorities veterinary surgeons carry out th



Vetch (Kidney)
A, Seed Pod. B, Flower.

administration of the Contagiou Diseases (Animals) Acts, and examin stallions under the Horse Breedin Act. Unless an animal receives sound certificate, he cannot travel fo stud purposes. Any person foun leading a stallion outwith his owner' premises without a certificate is liabl to prosecution. In the hope of secur ing a supply of milk which shall b

clean and free from the organism of tuberculosis, greater powers have been placed in the hands of veterinary surgeons acting on behalf of county councils and municipalities.

Tuberculin. Originally introduced by Koch as a remedy for tuberculosis in human beings, has now found its chief use as a diagnostic agent for tuberculosis in cattle. It can be used in a variety of ways, producing in animals affected with tuberculosis either a local or general reaction.

Mallein, prepared from the organism of glanders, and injected into suspected cases of glanders and in-contacts, has proved so reliable in diagnosis that Great Britain is free from this disease of horses. Glanders, once the scourge of armies in the field, was during the European War kept under control by the frequent testing of horses with mallein.

Active steps have been taken in recent years to produce agents known as vaccines, prepared from disease germs, and having the property, when they have been injected into an animal's system, of rendering the animal immune from the disease. The Animals' Diseases Research Association is a body of workers in this field which at present is dealing specially with braxy and dysentery in sheep, grass disease in horses, and joint-ill in foals.

For joint-ill in foals the following method has given the most satisfaction. Inject into the mare a vaccine prepared from streptococci, staphylococci, and bacilli coli as soon after the seventh month of pregnancy as possible; give her three injections at weekly intervals. Immediately the foal is born it should receive an injection of anti-streptococcus serum, this to be repeated in seven days. In addition, the navel should receive a frequent dressing of an antiseptic such as strong tincture of iodine.

Milk fever, once a deadly affection amongst milk cows, has now a very low mortality, thanks to the efforts of a Danish veterinary surgeon, who suggested the inflation of the udder with air. When a cow becomes attacked with milk fever, the treatment consists of stripping the udder as empty of milk as possible, and the pumping of air into each quarter of the udder through a hollow needle introduced into each teat. Cows that are delirious frequently become quieter even before the whole of the quarters are inflated. As in human surgery, so in veterinary surgery the introduction of antiseptics and anæsthetics has made operations possible that were formerly impossible.

It is only in the dog and the cat that abdominal surgery is carried out to any great extent. Foreign bodies in the stomach, intestines, and bladder are all removed in the dog and cat with good results, advantage being taken of X-rays in diagnosis. For distemper in dogs, moculative treatment has recently been used with considerable success.

Roaring in horses, an incurable disease due to paralysis of one or both vocal cords, which was formerly only relieved by the performing of tracheotomy and the wearing of a permanent tube, is now alleviated by an operation introduced by Williams of New York, and largely practised in this country. The horse having been put under chloroform and laid on his back, the larynx is opened. If a horse roars from paralysis of the cord, one or both vocal cords will fail to move on respiration.

The aim of the operation is to produce a shrinking or wasting of these cords, so that they will not lie dead in the passage. This result is brought about by removing the lining membrane of a cul-de-sac in front of the cord known as the ventricle, and it is hoped that in the healing process the contraction will be so great as to pull the paralysed cord hard up against the wall of the larynx.

Under the Anæsthetics Act certain specified operations on animals must either be performed under local anæsthesia or general anæsthesia. The horse and cow stand chloroform very well; the dog requires more care and attention; but sheep are most susceptible. Veterinary patients are frequently secured or cast before the anæsthetic is administered, as, during the period of excitement, they would be apt to break loose.

VETO (Lat., "I forbid"). The power which one branch of the legislature of a State has to negative the resolutions of another branch; or the right of the executive branch of Government, such as King, President, or Governor, to reject the bills, measures, or resolutions proposed by other branches.

In Britain the power of the Crown is confined to a veto, a right of rejecting and not resolving, and even this right is rarely exercised, the last occasion being in 1707; while the power of the House of Lords to veto bills which had passed the Commons was curtailed by the Parliament Act, 1911.

In the United States the President may veto all measures passed by Congress, but after that right has been exercised the rejected bill may become law by being passed by two-thirds of each of the Houses of Congress.

VEVEY. A town of Switzerland, in the canton of Vaud, on the north-eastern side of the Lake of Geneva. Pop. (1930), 13,036.

VIANNA. A town of Brazil, in the state of Maranhao. It trades in cattle. Pop. 13,000.

VIANNA DO CASTELLO. A town of Portugal, in the province of Minho, capital of the district of Vianna; served by the Oporto-Moncao Railway. It is one of the most beautiful towns of Portugal. There is a fishing industry which centres on the harbour, and trade is carried on in oil, wine, grain, etc. Pop. 10,520.—Another **Vianna** is in Alemtejo, on the Lisbon-Villa Real de San Antonio Railway.

VIAREGGIO. A town of Tuscany, North Italy, in the province of Lucca, on the Ligurian Sea; served by the railway from Genoa and by a branch to Lucca. It is in the Riviera di Levante. Near by, at Bagni di Nerone, are the remains of the Roman baths. Pop. 28,000.

VIBORG. A town of Denmark, on the Lake of Viborg. Manufactures include linen and tobacco. Pop. 16,635.

VIBORG, or **WIBORG.** A seaport of Finland, capital of a province of the same name, on a deep inlet of the Gulf of Finland, 74 miles north-west of Leningrad. It has an active export trade. It has a broadcasting station (291 m., 13·2 kw.). Pop. (1930), 55,750.

VIBRATIONS. *See* SOUND; HARMONIC MOTION; HARMONICS; RESONANCE; WAVE THEORY OF LIGHT; WIRELESS TELEGRAPHY; WAVES.

VIBUR'NUM. A genus of plants, nat. ord. Caprifoliaceæ, including the guelder-rose and laurustine (q.v.), and *V. Lantâna*, the wayfaring tree, a native of Europe and the west of Asia. The young shoots are used in Germany for basket-making; the wood is sometimes employed in turning and cabinet-making; the berries are used for making ink, and the bark of the root for making bird-lime.

VIC'AR (Lat. *vicarius*, substitute, from *vice*, in place of). In a general sense, a representative or vicegerent. The Pope calls himself *vicar of Christ on earth*. In the Church of England a vicar is the priest of a parish who receives only the smaller tithes or a salary, the greater tithes being received by a lay-rector. A *vicar apostolic*, in the Roman Catholic Church, is a bishop who possesses no diocese, but who exercises jurisdiction over a certain district by direct authority of the Pope; *vicar gen* the official assistant of a bisho archbishop.

VICENZA (vi-chen'tsâ). A pro province of Venetia, North It Area, 1051 sq. miles; pop. (19 528,256.

VICENZA. A town of Vene North Italy, capital of the prov of Vicenza, on the Bacchiglione its confluence with the Rentro served by the trunk line Venice-Mi and the branch railway Trev Vicenza (38 miles). The older pu buildings are almost all the work Palladio, who was born here, or scholars who rather slavishly imita him. Such are the Duomo or cat dral; the Palazzo della Ragi (town-hall), an ancient Gothic bu ing; the Museum, one of Pallad finest buildings; the Palazzo-F fetizzio; and the theatre. Manuf tures include silk, woollen, and li tissues, leather, earthenware, a hats. Pop. (1931), 65,177.

VICH (vich). A city of Spain, the province of Barcelona, with cott and other manufactures. Pop. 12,1

VICHY (vē-shē; Rom. *Vicus Ca dus*). A town and spa of France, the department of the Allier. It w once a place of strength, and celebrated for its thermal alkali springs, twelve in number, known the Romans as the *Aquæ Calidæ*. T Vichy waters are in much reque for disorders of the stomach a bowels and of the urinary organs, gout, rheumatism, etc. The water bottled for export. Pop. 22,207.

VICKSBURG. A city and port entry of Mississippi, United State the county seat of Warren count on the Mississippi at its confluen with the Yazoo; served by t Alabama & Vicksburg, and other rai ways. It has railway repair- an construction-shops, and has manufa tures of cotton-seed cake and oil, an wooden goods, and a brisk trade i cotton. The district was settled i 1811, and the town, which became city in 1836, was laid out in 1824.

It was strongly fortified by th Confederates in the Civil War, an the Unionist forces were repulsed her on several occasions, but after a lon siege General Pemberton surrendere the place to General Grant, 4th July 1863. Pop. (1930), 22,943.

VICTOR AMADEUS II. Duke o Savoy, and first king of Sardinia born 1666, died 1732. He joined th Austrians in the War of the Spanis Succession, and at the Peace o Utrecht (1713) he obtained the addi tion of Sicily to his dominions. I 1720 he gave up that island to th

Austrians in exchange for Sardinia, and then took the title of King of Sardinia. He abdicated in favour of his son, Charles Emmanuel III., in 1730.

VICTOR EMMANUEL (Vittorio Emanuele) II. King of Sardinia from 1849 to 1861, and of Italy from 1861 to 1878, born in 1820, died in 1878. He was the son of Charles Albert, King of Sardinia, and on 12th April, 1842, he married the Archduchess Adelaide of Austria. His aptitude for a military career became evident when he commanded the Savoy brigades against Austria (1848-9), and distinguished himself in the battle of Goito by his reckless valour. After the battle of Novara (23rd March, 1849) his father abdicated, and Victor Emmanuel ascended the throne of Sardinia.

He had then to negotiate with Austria under most unfavourable circumstances, but he steadily refused to give up the principle of representative government in the Sardinian Constitution, and this gained for him the name of honest king (*re galantuomo*) and the goodwill of the Italian people. This latter was only gained, however, after much calumny and misunderstanding, but the young king pursued from the first a policy which led to the national unity of Italy.

Under the advice of his celebrated minister Cavour, he regulated the finances, reorganised the army, and secularised the Church property, for which he was excommunicated by the Pope. He took part in the Crimean War, and in 1859, assisted by France, renewed the contest with Austria, taking part in the battles of Magenta (4th June) and Solferino (24th June).

By the Treaty of Villafranca and the Peace of Zürich which followed these successes, Lombardy was added to his dominions, but he had to cede Savoy and Nice to France. Parma, Modena, and Tuscany now became united to Sardinia, and Garibaldi's successes in Sicily and Naples brought the whole of Southern Italy over to Victor Emmanuel.

On 17th March, 1861, he assumed the title of King of Italy, and early in 1865 Florence became the royal residence. By the Peace of Vienna (1866) Austria ceded Venetia, and on the withdrawal of the French garrison from Rome in 1870 the city was annexed to Italy, when the king entered Rome (2nd July, 1871) and took up his residence in the Quirinal. *See* SARDINIA; ITALY; FRANCE.

VICTOR EMMANUEL III. King of Italy, born at Naples 1869, son of Humbert I. and of Margherita. He entered the army, and frequently represented his father on important occasions abroad. In 1896 he married Princess Helena of Montenegro, and on the assassination of his father ascended the throne of Italy (11th Aug., 1900). When Italy joined the Allies in the European War, the king assumed command of the Italian armies on the Austrian front.

VICTORIA, QUEEN, Alexandrina Victoria. Only child of Edward, Duke of Kent, fourth son of George III., by his wife, Mary Louisa Victoria, daughter of Francis, Duke of Saxe-Coburg, and widow of Ernest, Prince of Leiningen, born on 24th May, 1819. Her prospect of the succession to the crown was somewhat remote, for her father might reasonably hope for a male heir; his three elder brothers were alive, and one of them, the Duke of Clarence, afterwards William IV., had recently married.

The deaths of the princess's father in 1820 and of her cousins, two daughters of the Duke of Clarence, in 1819-20, placed her next in the succession to her two elderly uncles, the Dukes of York and Clarence. The Duke of York died in 1827, and on the accession of William IV. in 1830 Victoria became heiress-presumptive to the throne. She had been brought up very quietly, but from 1830 she began to make public appearances, to the annoyance of King William, who was on very bad terms with the Duchess of Kent.

Her coming-of-age, on her eighteenth birthday, was the occasion of some public rejoicings, and on 20th June of the same year (1837) she succeeded her uncle, creating a most favourable impression by the tact and composure which she displayed in difficult circumstances. Her accession involved the separation of the crowns of Great Britain and Hanover, the latter passing to the nearest male heir, her uncle, the Duke of Cumberland.

In the first years of her reign, Queen Victoria was under the guidance of her Whig Prime Minister, Lord Melbourne, who devoted himself to the task of training a young girl for her high responsibilities. The General Election, which by the then existing law followed her accession, gave the Whigs a reduced but adequate majority; but in the summer of 1839 Melbourne's position in the Commons became so weak that he resigned, and the young queen had her first political difficulties in a controversy with Sir Robert Peel, who, in taking office, proposed to replace the Whig Ladies of the Bedchamber by Con-

servatives. On her refusal, Peel declined to take office, and Melbourne returned to power for two more years; but the queen, who was taken by surprise and given insufficient time for consideration, afterwards admitted that she had been "foolish," and no similar difficulty arose again.

The influence of Melbourne diminished after the queen's marriage on 10th Feb., 1840, to her cousin, Prince Albert of Saxe-Coburg, whose wide interests and sagacious counsel had an important effect upon the development of the queen's character, though he never acquired popularity in his adopted country. Their first child, afterwards the Empress Frederick, was born on 21st Nov., 1840, and the Prince of Wales (Edward VII.) on 9th Nov., 1841; seven other children followed between 1843 and 1857.

During the years of her married life, Queen Victoria played a considerable part in foreign policy, and on several occasions her personal intervention improved foreign relations, especially with France. No sovereign of this country had left the island since George II. (except for a brief visit of George IV. to Hanover), but Queen Victoria made royal visits a part of the peace-loving diplomacy of her Governments, and she paid special attention both to Louis Philippe and Napoleon III., who owed to her his reception into the royal circles of Europe.

She also showed an affection for Scotland (which, except for the visit of George IV. to Edinburgh in 1822, had received no sovereign since the middle of the seventeenth century), and made one of her homes at Balmoral, in Aberdeenshire.

Her relations with her ministers during this period were generally cordial, though she had grave disagreements with Palmerston, whose foreign policy she distrusted. Her desire for the maintenance of peace led, just before the outbreak of the Crimean War, to many misrepresentations of her attitude, which was supposed to be too friendly to Russia. The death of her husband (who in 1857 had been created Prince Consort) took place, from typhoid fever, on 14th Dec., 1861, and this event changed the whole tenor of the queen's life.

During many years of her widowhood, Queen Victoria lived in almost complete seclusion. She had been the first sovereign to reside in Buckingham Palace, but after 1861 she was rarely in London, and preferred Balmoral and Osborne (her home in the Isle of Wight) to Windsor, and her disinclination to appear in public was the subject of numerous c plaints. Her devotion to her o duties was, however, undiminis and she continued to exercise s influence on foreign policy, and a cated neutrality in the Danish of 1864.

She was on terms of intimate fri ship with one of the Prime Minis of this period of her reign—Disrae and his Royal Titles Act of 1 which conferred on her the dignit Empress of India, gave her spe pleasure. She did not like W. Gladstone, and did not conceal reluctance to ask him to form Government in 1880, and her distr of his policy was increased by course of events in Egypt and Sudan. In the last years of her re she welcomed the Unionist admi trations of 1886 and 1895.

Queen Victoria suffered ma family griefs, for two of her child and several of her grandchildren p deceased her. She felt deeply the l of her son-in-law, the Emperor Fr erick, in 1888. She had watched w anxiety the aggressive policy of G many and Bismarck, and had warn her daughter that this country "ca not and will not stand" the attem of the German Empire "to dicta to Europe," and she trusted that h son-in-law's succession would produ a change in German policy. H sorrow was increased by the Empe William's treatment of his moth but she remained on cordial ter with her grandson to the end of h life.

Her own domestic griefs render her sympathetic with the sorrows her people, and as she grew older sh more than recovered her early pop larity, and was regarded with affe tion by the whole Empire. Th affection was illustrated by the en thusiasm for her person which wa shown on the occasions of her jubilee in 1887 and 1897. Her last year were clouded by the outbreak of th South African War and by the disas ters of the opening campaign, but sh lived long enough to welcome Lor Roberts on his return in Jan., 1901 She died less than three weeks later on 21st Jan., 1901, and was buried at Frogmore, near Windsor, on 4th Feb., the funeral service taking place at Windsor on 2nd Feb.

Queen Victoria was a woman o robust physique, remarkable power of memory, great force of character deep sympathy, and sincere religious feeling. She was very tenacious of he own opinions, but understood thor oughly the position of a constitutiona sovereign, and her strong commo sense kept her prejudices in check She has left a great name on the rol

ritish sovereigns.—BIBLIOGRAPHY: . Benson and Lord Esher (editors), *Letters of Queen Victoria* (*1837-*; Sir Sidney Lee, *A Life of Queen 'oria*; G. Lytton Strachey, *Queen 'oria.*

ICTORIA. A state of the Com-nwealth of Australia, bounded th by New South Wales, south-t by the Pacific, south by Bass ait and the Southern Ocean, and st by South Australia; area, 884 sq. miles (see table under EENSLAND).

Physical. There is a coast-line of) miles (i.e. 129 sq. miles of area 1 mile of seaboard). The state is versed by the Victorian Highlands, western projection of the East stralian Highlands, which, as the stralian Alps (Mt. Bogong, 6508 t altitude) and the Great Dividing nge, run from east to west with creasing altitude across Victoria d form the watershed between reams flowing to the Murray, the rthern boundary of the state, and ose belonging to the hydrographic stem of the Great Valley of Victoria the south.

Trending north and south at the estern end of the Victorian High-nds are the Grampians (Mt. William 329 feet altitude). In the north-est of the state are the Mallee lains, part of the Great Plains, so alled from the Mallee (*Eucalyptus Dumosa*) which formerly covered hem. Part of the Great Valley lying vest of Port Phillip is covered with ava flows discharged from many olcanic vents, some of which show nly by the worn plug of lava that topped the pipe of the volcano, while thers are still covered by volcanic ills.

These lava plains, covering about 0000 sq. miles of Western Victoria, re studded with lakes, both salt and resh, and have such a good rainfall nd rich covering of turf as to turn he attention of the first settlers nevitably towards pastoral pursuits.

Rivers flowing northwards to the Murray include the Mitta-Mitta, Ovens, and Goulburn; those flowing to Bass Strait, etc., comprise the Snowy, Mitchell, Macallister, and Glenelg Rivers. Most of the latter find their way into lagoons pent up behind storm beaches, such as the Ninety Mile Beach (which encloses the noted Gippsland Lakes, Wellington, Victoria, and King respectively) on the eastern seaboard, and from these lagoons disembogue to the sea. The Yarra-Yarra, upon which Melbourne stands, discharges into Port Phillip Bay.

Climate. The climate is temperate, with a mean annual temperature of 58·4° F. (July, 48·6°; January and February, 67·5°), rainfall (66 years' observations) about 25·66 inches per annum.

Production. Victoria is the second gold-producing state of Australia, the metal being found in the district of Bendigo, Gippsland, Maryborough, Beechworth, Ballarat, and Ararat and Stawell. Lode workings are the chief, but there are considerable alluvial workings. Iridosmine exists at Foster and Waratah, and platinum is found (associated with copper) in Gippsland.

In order of value the mineral production is gold, coal, tin and tin ore, antimony ore, phosphate, molybdenite, kaolin, silver, gypsum, diatomaceous earth, gems, and wolfram. The pastoral industry is all-important. Wool is the chief product, and the sheep-walks are very extensive.

Beef-production and dairying, including the making of butter, cheese, condensed milk, and other milk-products, are progressive. About 50 per cent of the agricultural area is devoted to wheat, 30 per cent to hay, 10 per cent to oats (Victoria being the leading oat-producing state of Australia), and the rest to viticulture, fruit-farming (apples, apricots, peaches, pears, and plums), and to crops such as barley, of which, after South Australia, Victoria produces the heaviest crops in the Commonwealth.

Manufactures include leather and other products connected with the pastoral industry, clothing and textile fabrics, food, drink, and wooden goods, etc.

Constitution. Victoria is divided into rural and urban municipalities. In 1931 there were 56 urban municipalities in the State. The government is vested in a Governor appointed by the Crown, aided by a ministry of eight salaried members, and a Parliament consisting of a Legislative Council of thirty-four members elected for six years, one half seeking re-election every three years, and a Legislative Assembly of sixty-five elected for three years.

Education. Education is compulsory between the ages of six and fourteen years. Besides the Melbourne University there are several colleges connected with various religious denominations.

History. Victoria was first colonised from Tasmania in 1834. It made rapid progress, especially in sheep breeding, and the discovery of gold in 1851 caused a rush of population from all parts. Hitherto it had been known as Port Phillip, and formed part of New South Wales, but in this year (independently of the gold dis-

covery) it was erected into a separate colony under the name of Victoria. In 1850 the population numbered 76,162; in 1854 it was 312,307.

In 1856 responsible government was conferred on the colony, and in 1900 became a state of the Australian Commonwealth.

Towns and Population. The chief towns are Melbourne (the capital), Ballarat, Bendigo, and Geelong. Pop. in 1881, 862,346; in 1891, 1,140,405; in 1901, 1,201,341; and in 1932, 1,805,298. In Melbourne alone (pop. Dec., 1931, 1,030,750) 51·27 per cent of the population of the state is concentrated.

BIBLIOGRAPHY: *Official Year Book of the Commonwealth of Australia, No. 14 (1921)*, article *Evidence of Post Volcanic Action in Australia*; *Oxford Survey of the British Empire—Australasia*; H. Gyles Turner, *History of Victoria*; *Victorian Year Book*; J. W. Gregory, *Australia and New Zealand* (vol. i. of *Australasia* in Stanford's *Compendium of Geography and Travel*); *Geography of Victoria*.

VICTORIA. Capital of British Columbia, at the south end of Vancouver Island, on an inlet from the Strait of Juan de Fuca; served by steamers and by the Esquimault & Nanaimo Railway, of which it is the terminus. Victoria was founded in 1823, and has developed into a seaport of importance with many industries, including the manufacture of paints, canned goods, biscuits, dried fish, jams, machinery, soap, and bricks. Esquimault, 3 miles distant, is a naval station, and has a Dominion Government dry dock. Pop. (1931), 60,000.

VICTORIA. A seaport-city of Brazil, capital of the state of Espirito Santo; served by rail to Rio. Coffee is the main article shipped, but tapioca, rice, and sugar are loaded by coasting steamers. Pop. 14,860.

VICTORIA. A large island of Northern Canada, in the district of Franklin. It is separated from the mainland by Coronation Gulf, Dease Strait, Queen Maud Sea, and Dolphin and Union Strait. It comprises Prince Albert Land and Wollaston Land.

VICTORIA. The name of several towns in British overseas territories: (1) a seaport-town (pop. 1500), the capital of Labuan (q.v.); (2) a town of Southern Rhodesia (q.v.); (3) the capital and harbour of the Seychelles, on Mahé, an Admiralty coaling-station; (4) the seaport-capital of Hong-Kong (q.v.); and (5) a seaport-town in the British sphere of the former German *Kamerun*, the centre of large cocoa, rubber, and banana plantations; gives name to on the four districts (Bamenda, (dinge, Victoria, Kumba) formin division administered by a resi with headquarters at Buea). toria and Sopo (10 miles below B are connected by light railway. I about 2500.

VICTORIA, LAKE (*Victoria Nyanza*). A lake of East Africa, ab 400 miles inland from the Ind Ocean, crossed near its north end the equator; area, 26,000 sq. mi or nearly as large as Scotland. communicates with Lake Albert means of the Victoria Nile, and the principal feeder of the Wh Nile. It contains many islands, so of them of considerable size. It v discovered by Captain Speke in 18 It is entirely within British territo and is easily reached by railway fr Mombasa.

VICTORIA AND ALBERT M SEUM. *See* KENSINGTON (SOUT MUSEUM.

Victoria Cross

VICTORIA CROSS. A decoration instituted on 29th Jan., 1856, at the close of the Crimean War, for the purpose of signalising special individual acts of bravery. It may be conferred upon those holding any rank in the navy, army, or Air Force, and carries with it a pension of £10

ratings and non-commissioned cers and men.

The decoration is a bronze cross ée with the royal crown in the tre, surmounted by the lion, and lerneath a scroll bearing the in- iption "For Valour." It is made m the metal of cannon captured Sebastopol. Additional acts of very are recorded by extra bars ixed to the ribbon (1½ inches in dth) suspending the Cross. Prior 1918 this ribbon was blue for naval cipients and red for military ones; is now red for all three services. Since 1918 a miniature replica of e decoration has been worn on the bon in undress and service dress iiform. Native officers and men of e Indian army were made eligible r the Victoria Cross in 1912. Reci- ents place the letters V.C. after their ames. Between 1856 and 1914 about 5 Victoria Crosses were awarded; uring the European War 581 were iven.—Cf. Major Rupert Stewart, *The Book of the Victoria Cross.*

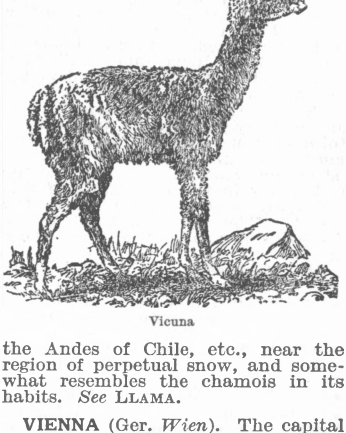
VICTORIA FALLS. A cataract of ne Zambezi, in Rhodesia, not far om its western boundary. The river ere, nearly a mile broad, drops 340 eet into a narrow transverse fissure r crack crossing its course, the water hen passing away in a narrow rocky orge. A great railway bridge now rosses the river here; and it has been proposed to utilise the falls to enerate electric power for the Johan- esburg gold-mines and other pur- oses.

VICTORIAN ORDER, THE ROYAL. A British order of knighthood established by Queen Victoria in April, 1896. There is no limit to the number of members, and the order, which is conferred for extraordinary, important, or personal services to the sovereign or the royal family, can be bestowed upon foreigners as well as upon British subjects.

The order is divided into five classes: Knights Grand Cross (G.C.V.O.), Knights Commanders (K.C.V.O.), Commanders (C.V.O.), and Members of the Fourth and Fifth Classes (M.V.O.). The ribbon of the order is dark blue with a narrow edge of red, white, and red.

VICTORIA UNIVERSITY. Formerly a federal university consisting of Owens College, Manchester, University College, Liverpool, and Yorkshire College, Leeds. It was founded by Royal Charter in 1880, but in 1903 the Liverpool college was separated to form the University of Liverpool, and the other two colleges received separate charters in 1904 as the Victoria University of Manchester and the University of Leeds. Among distinguished scientists who have been associated with Victoria University are the chemists Roscoe, Pope, and W. H. Perkins; the physicists Balfour Stewart, Schuster, and Rutherford; and the engineers Reynolds and John T. Nicolson.

VICUÑA (vi-kun'yà). A ruminant animal (*Lama vicugna*) closely allied to the llama. It is a native of South America, frequenting the slopes of



Vicuna

the Andes of Chile, etc., near the region of perpetual snow, and somewhat resembles the chamois in its habits. *See* LLAMA.

VIENNA (Ger. *Wien*). The capital of Austria, on the right bank of the River Danube; the nodal point of the Austrian railways. The city consists of the Innere Stadt, or old town, and numerous municipal districts, besides extensive suburbs. The old town is encircled by the magnificent avenue of the Ringstrasse, marking the site of the ancient fortifications, which till 1856 protected the city against Asiatic foes. The Prater, a public park on the bank of the Danube, is considered the finest public park in Europe.

Of the churches the chief is the Domkirche, or cathedral of St. Stephen, a cruciform Gothic structure of the fourteenth and fifteenth centuries. Its main tower, about 450 feet in height, was built between 1359 and 1433, and partly reconstructed between 1860 and 1864. It contains a bell weighing over 20 tons, and cast from captured Turkish cannon. The other noteworthy churches are: the Augustinian church (1330), containing the hearts of the dead members of the Habsburg family;

the Bohemian National church (Maria am Gestade), built 1340-94 and restored 1820; the Italian National church (Maria-Schnee); the University or Jesuit church (1628-31), in Late Renaissance style; the Capuchin church, with the burying-vault of the Habsburgs; the Votiv-kirche (1856-79), one of the finest examples of modern Gothic.

The former imperial palace (Kaiserliche Hofburg), in the heart of the city, is a large and ancient structure, with modern additions. Among other buildings are Parliament building (1883), in Greek style, the town-house (1872-83), the Palace of Justice (1875-81), in German Renaissance style, the museums of art and natural history, both Renaissance buildings, and the Exchange. The university was founded in 1365.

There are also theological institutes, an academy of fine arts, a conservatoire of music, public libraries and museums, and a number of gymnasia and other schools. Some of the collections in the museums and galleries are among the finest in the world. The principal theatres are the Hofburg and the fine Opera House.

Manufactures include silks, woollens, cottons, machinery, cycles, scientific instruments, musical instruments, safes, furniture, art objects jewellery, chemicals, beer, leather goods, artificial flowers, etc. There is a large trade both by rail and river. The mean annual temperature is 48·7° F. (January, 29°; July, 68°), and the rainfall about 24·5 inches. May to August inclusive are the wettest months, and February is the driest. It has two broadcasting stations (1237 m., and 517 m., 15 kw.).

Vienna, the pre-Roman *Vindomina*, was the Roman *Vindobona*, the headquarters first of the XIIIth, then of the Xth Legion, and the place where Marcus Aurelius died. Taken by the Ostrogoths and the Huns, Charlemagne seized it about 791; it became the seat of the Margraviate of Austria (1142) and a free imperial city (1237). Rudolf von Habsburg seized the city in 1276, and it became thenceforth the seat of the Habsburgs until the downfall of the Austrian Empire in 1918 (*see* RUDOLF I., etc.).

Among noted sieges were those of the Turks in 1529 and again in 1683. In 1723 the bishopric (dating from 1480) became an archbishopric. The French seized the city in 1806 and 1809, and the Congress of Vienna (q.v.) sat there (1814-5). From being the capital of an empire, Vienna has now sunk to the peculiar position of capital of a second-rate state. Pop. (1930), 1,865,780.

VIENNA, CONGRESS OF (1814 The Congress of Vienna met in Se 1814, to determine the settlement Europe after the abdication of Na leon in April and the conclusion the First Peace of Paris in May. T treaty, the signature of which stored France to a place among European Powers, provided only immediate necessities, and relega many important questions to a C gress in which France was represent by Talleyrand, who soon found amc the Allies differences of opini which enabled him to secure st port.

Progress was long delayed by d putes, and it was not until Jan., 181 that the "real Congress," compos of representatives of Great Brita Austria, Prussia, Russia, and Franc began to draft a treaty.

Their deliberations were interrupt by the escape of Napoleon from Elb but they were concluded a few da before the battle of Waterloo. It w agreed that Germany (including Au tria) should become a confederatic of thirty-eight states by the ama gamation of many of the small stat which had existed before the revolu tionary wars.

Prussia was given a large increas of German territory, including th Rhineland. Austria was made th president of the German Confedera tion, and received Lombardy an Venice. Elsewhere in Italy, the state of the Church were restored to th Papacy, and Naples and Sicily t their Bourbon monarch. Belgium was united with Holland, and Grea Britain acquired colonial possessions including Malta, Heligoland, Ceylon and the Cape of Good Hope.

After the defeat and surrender o Napoleon, these arrangements were challenged by the Prussians, who advocated the dismemberment of France, but the British representatives in the Allied councils, Castlereagh and Wellington, opposed a policy of spoilation and were supported by Russia and Austria. The Prussians had to give way, and the Second Peace of Paris (Nov., 1815) did not seriously alter the arrangements made in the First Peace and at the Congress of Vienna.

The settlement made by the Congress was guided by the belief that revolutions must lead to war and that a series of strong monarchies formed the best guarantee of European peace, and by the principle of maintaining a balance of power. The dislike of its members to constitutional government was the weakest point in the settlement; its strongest was the creation of something like a Concert of Europe, which did, in

, keep the peace for a consider- number of years.
he "Holy Alliance," often asso- ed with the Congress, was actually ded after its close, and was merely ious opinion, expressed by Russia formally accepted by Prussia and stria. It had no political influence, the Quadruple Alliance, made in vember, by Britain, Russia, Aus- , and Prussia, provided for the embly of congresses to settle dis- ed questions. — BIBLIOGRAPHY: K. Webster, *The Congress of nna*; R. B. Mowat, *A History of ropean Diplomacy in the Nine- nth Century*; *Cambridge History of itish Foreign Policy*.

VIENNE (vē-enn). A western de- rtment of France, in the old pro- nce of Poitou, bounded by the partments of Indre-et-Loire, Indre, aute-Vienne, Charente, Deux- vres, and Maine-et-Loire; area, 2711 . miles. The surface is generally t; it is well watered, chiefly by the enne and its tributaries. Wheat, ts, barley, rye, fruit, and wine are oduced, and cattle and sheep are ised. Iron is worked, and there are so stone-quarries. Manufactures clude woollens, lace, cutlery, paper, d pig-iron. The capital is Poitiers. op. (1931), 303,072.

VIENNE (Rom. *Vienna Allobro- um*). A town of France, in the de- artment of Isère, on the Rhône, at he confluence of the Gère; served y the trunk line of the Paris-Lyons- Mediterranean Railway. It has an ncient cathedral. Vienne contains umerous Roman remains. Pop. 5,468.

VIENNE, HAUTE-. A hilly de- partment adjoining the department of Vienne on the south-east; area, 2119 sq. miles. Almost the whole department belongs to the basin of the Loire, and it is crossed by the upper course of the Vienne. The principal crops are buckwheat, rye, beans, and peas; and horses, mules, and swine of a superior breed are reared. Minerals include iron, copper, tin, lead, coal, antimony, and kaolin. Porcelain, woollen and other tissues, paper, and leather are the chief manufactures. Limoges is the capital. Pop. (1931), 335,873.

VIENTIANE. Capital of Laos.

VIEQUES. *See* PORTO RICO.

VIERNHEIM. A town of Germany, in the Hessian province of Starkenburg; a railway junction on the lines Weinheim-Mannheim and Weinheim-Lampertheim. Cigar factories provide the chief employment; other industries are malting, sawmilling, and the brewing of beer. Pop. 10,000.

VIERSEN. A town of the Rhineland, Germany, in the Düsseldorf district, on the Niers; a junction on the railway München-Gladbach-Ruhrort. Industries include the manufacture of silks, plush and satin, linen and cotton, machinery, paper, chocolates, leather, and electrical goods. Pop. 32,169.

VIERZON. A town of France, in the department of Cher, on the Yèvre at its confluence with the Cher, and on the Canal du Berry; a junction on the main line Paris-Orleans-Toulouse, for Montluçon and Laqueville (150 miles), and for Tours. Manufactures include porcelain, glass, and agricultural machinery. Pop. 11,860.

VIETA, Franciscus, or **François Viète.** French mathematician, born 1540, died 1603. He made important advances in algebra, especially in methods for solving equations, and was the first to solve the celebrated problem of Apollonius—to describe a circle to touch three given circles—without the aid of conic sections.

VIGEVANO (vi-jev'à-nō). A town of Italy, in the province of Pavia, near the right bank of the Ticino, 15 miles S.S.E. of Novara. It is a bishop's see, and has manufactures of silks, hats, soap, and macaroni. Pop. 30,000.

VIGFUSSON, Gudbrandr. Icelandic philologist, born in 1828, died in 1889. He studied in Copenhagen, but was called to England in 1864 to complete the *Icelandic-English Dictionary*. This work was published between 1869 and 1874, and in 1884 Vigfusson was appointed reader in Scandinavian at Oxford.

VIGNY (vēn-yē), **Alfred Victor, Comte de.** French poet, novelist, and dramatist, born in 1797, died in Paris in 1863. A small volume of *Poèmes* published in 1822 attracted little attention. It was followed by the more important *Poèmes Antiques et Modernes* in 1826, containing such finely mystical pieces as *Moïse*, *Éloa ou La Sœur des Anges*, and *Le Déluge*. The same year witnessed the appearance of the historical novel *Cinq-Mars ou une Conjuration sous Louis XIII.*, which shows the influence of Sir Walter Scott.

De Vigny's first theatrical venture was a translation of *Othello* (1829); it was followed by *La Maréchale d'Ancre* (1831) and *Chatterton* (1835), the latter of which was brilliantly successful. Other works are *Consultations du Docteur Noir* (1832), *Servitude et Grandeur Militaires* (1835), and the posthumous *Les Destinées* (1864), the first two in prose, the last a philosophical poem. A part of his

journal was given to the world in 1867.

From 1845 he was a member of the Academy. De Vigny was associated with the romantic movement in French literature, but he stands apart from its main stream. Grandeur, simplicity, and solemnity are the dominant characteristics of his poetry, and his outlook is that of pessimistic stoicism.—Cf. E. Lauvrière, *Alfred de Vigny*.

VIGO. A city and seaport of North-Western Spain, in the province of Pontevedra, on the south side of the Ria de Vigo, on the slope of a hill crowned by a fort, 80 miles S.S.W. of Corunna. The fishing of sardines and tunnies is important, and there is an active foreign trade. The sea-bathing is excellent. On 12th Oct., 1702, Admiral Rooke at the head of an English fleet completely defeated a Franco-Spanish fleet in the bay and captured a large amount of treasure. Pop. 53,091.

VIKINGS, WICKINGS, or **NORTHMEN.** Sea-rovers from the Scandinavian Peninsula who migrated, in successive waves, to France, Flanders, and the British Islands from the eighth century to the thirteenth. At first they were mere freebooters who landed in a creek and ravaged the district, their light vessels being capable of navigation up river-mouths, but from the middle of the ninth century they began to make permanent settlements. In 845, 857, 861, and again in 886, they attacked Paris, and some of them at this date penetrated to the Mediterranean and the coasts of Italy.

Their first great settlement was in the north of France, where Rolf, the leader of a band of Northmen, received from Charles the Simple territory between the Channel, the Seine, and the Epte, which his son subsequently extended to form the Duchy of Normandy, and the Normans thenceforth played a large part in the history of France and, afterwards, in that of England and Italy.

The invaders who settled in England in the ninth, tenth, and eleventh centuries, and against whom Alfred and his descendants waged war, were Danes and not Norsemen; but the Norsemen made numerous settlements in Ireland and in Scotland, where Olaf the White founded in 852 a Scandinavian kingdom, including both Danes and Norsemen.

In Scotland they began to attack the west coast in 794, and they soon made settlements there, both on the mainland and in the islands, including Orkney and Shetland, whence they migrated into Caithness and spread along the coast as far south as the Moray Firth. Other bands formed colonies in Dumfriesshire and Kirkcudbrightshire, and penetrated inland to Peebles.

In the Western Islands, in Orkney and Shetland, and in Caithness the population became definitely Scandinavian, and these regions belonged for some centuries to the Kingdom of Norway. The Vikings also colonised Iceland and portions of Greenland, and they even made their way to North America. Other settlements

Viking

were made in Russia, and Norsemen formed the Varanger Guards at Constantinople. The Vikings were heathens, and their ravages were unrestrained by any feelings of pity or of reverence for religion.

Their character is described in the Eddic poems, which contain much of the romance of their history; they are described by York Powell as "a sturdy, thrifty, hard-working, law-loving people, fond of good cheer and strong drink, of shrewd, blunt speech . . . truthful, hospitable, liking to make a fair show, but not vain or boastful." To these qualities must be added remarkable skill and not less remarkable daring in navigation and in fighting, and remorseless cruelty. Relics of their vessels have been found in the Thames, the Lea,

the Seine, and elsewhere, and show the resources of these early shipbuilders.—BIBLIOGRAPHY: Collingwood and York Powell, *Scandinavian Britain*; *Cambridge Mediæval History*; A. H. Johnson, *The Normans in Europe*.

VILLACH. A town of Carinthia, Austria, on the Drava, near the confluence of the Gail; an important railway junction on the lines Leoben-Pontebba (via Tarvis), Marburg-Franzensfeste, and Salzburg-Assling, with a branch line to St. Veit (32 miles). Villach is primarily an industrial town, producing paper goods, colour and varnish, machinery, preserved fruit, leather, and beer. A large trade is carried on, notably in wood, with Italy. Nearby are the thermal springs (sulphuric; about 84° F.) of Villach with *Kurhaus*, etc. Pop. 22,100.

VILLAFRANCA. The name of several Italian towns. (1) A town of Verona, on the Tartaro; served by the railway Bologna-Brenner. It was the centre of the wars of 1848 and 1866, and was the place where peace was signed (11th July, 1859) between Napoleon III. and the Emperor of Austria. Pop. 12,000. (2) Villafranca in *Modena*, a junction for Finale on the railway to Mirandola. (3) Villafranca in *Lunigiana*, on the railway from Parma to the west coast. (4) Villafranca *Piemonte*; served by rail from Turin.

VILLAFRANCA. The name of several Spanish towns: (1) *de los Caballeros*, in Toledo province; (2) *del Bierz*, in Leon, terminus of a branch line from Toral de los Vados; (3) *del Campo*, in Teruel and in the Jiloca Valley; (4) *del Cid*, in Castellon; (5) *de los Barros*, in Badajos, on the Sevilla-Merida Railway; (6) *del Panades*, in Barcelona; (7) Villafranca in Guipuzcoa, on the railway San Sebastian-Zumarraga; (8) Villafranca in Navarra, on the railway Pamplona-Castejon.

VILLANELLE. One of the fixed forms of verse, originally a rustic song of any kind, but since the sixteenth century a very rigorously defined form. Florio in his *Italian-English Dictionary* (1598) translated *villanella* by "a ballat, such as countrie milke-maids sing." The word is ultimately derived from the Lat. *villa*, a farm, through the It. *villano*, a farm-hand. The villanelle was a pastoral poem made to accompany a rustic dance, and, though a refrain was always a necessary constituent, it originally obeyed no laws.

VILLARS (vil-ăr), **Claude Louis Hector, Duc de.** French soldier, born in 1653, died in 1734. In the Wars of the Spanish Succession he was sent to co-operate with the Elector of Bavaria. He defeated Prince Louis of Baden at Friedlingen, 14th Oct., 1702, for which he received the marshal's baton; and having joined the Elector, he defeated the Prince of Baden at Höchstadt, 21st Sept., 1703. His success in dealing with the insurrection of the Camisards obtained for him the title of duke (1705). He was in command at Malplaquet, and in 1712 defeated the Allies at Denain.

VILLEFRANCHE (*de Rouergue*). A town of France, in the department of Aveyron, at the junction of the Alzou with the Aveyron; served by the Orléans Railway. Pop. 10,000.

VILLEFRANCHE (*sur-Saône*). A town of France, in the department of Rhône, on the Saône; served by the Paris-Marseilles trunk line (P.L.M.), and by branches to Tarare and Monsol (via Beaujeau). Pop. 16,000.

VILLEHARDOUIN (vil-ăr-dụ-aṇ), **Goeffroy de.** French historian, born about 1160, died about 1213. He took an important part in the fourth Crusade, was present at the siege and capture of Constantinople, and when the Greek emperor was overthrown and Baldwin established in his stead, he received an extensive territory for himself in Thrace. His *Histoire de la conquête de Constantinople* is one of the most valuable historical works of the Middle Ages.

VILLEINS. *See* SERFS, VILLEINS, AND VILLEINAGE.

VILLENEUVE (vĕl-nеuv), **Pierre Jean Baptiste Silvestre de.** French admiral, born in 1763, died in 1806. He entered the navy in 1777, and became rear-admiral in 1796.

He led the rear division at the battle of the Nile, and escaped with his own and four other ships to Malta. In 1804 he was made vice-admiral, and in 1805 Napoleon appointed him to the command of the Toulon squadron. Defeated at Trafalgar in 1805, he was taken as prisoner to England. In April, 1806, he was released and returned to France, but learning that his reception by the emperor would be unfavourable, he committed suicide.

VILLENEUVE (Ger. *Neustadt*). A town of Switzerland, canton Vaud, on the east shore of Lake Geneva; served by the railway Lausanne-Brig. It is noted for white wine. Chillon (the castle) is nearby. Pop. 3000.

Among other Villeneuves (*all in France*) are: *d'Aveyron*, department Aveyron; on Figeac-Villefranche rail-

way ; pop. 2000 ; *d'Agen* or *sur-Lot*, depart. Lot-et-Garonne, on the Lot ; and on Penne-Tonneins railway ; plum-trading centre ; pop. 7000 ; *de-Berg* depart. Ardèche ; on Alais-Le Teil railway ; silk-spinning place ; pop. 2000 : *de-Marsan*, depart. Landes ; on the railway from Mont de Marsan ; thermal baths at Brousté ; pop. 3000 ; *la-Guyard*, depart. Yonne ; on Sens-Montereau railway ; pop. 2000 : *l'Archevêque* or *sur-Vanne*, depart. Yonne, on the Vanne ; on Sens-Troyes railway ; a great horse-trading centre ; pop. 2000 : *le-Comte*, depart. Seine-et-Marne ; on railway Lagny-Mortcerf ; pop. 3000 ; *lès-Avignon*, depart. Gard, on Rhône opposite Avignon ; and on Lyons-Nimes railway ; olive-oil made ; pop. 3000 ; *les-Béziers*, depart. Hérault ; on Béziers-Agde railway ; St.-*Georges*, depart. Seine-et-Oise, on the Seine ; on the P.L.M. (Paris-Moret section) and the Noisy-le-Sec-Juvisy circular railways ; pop. 7000 : *sur-Yonne*, depart. Yonne, on the Yonne ; and on Sens-Joigny (section P.L.M., railway ; wine- and grain-trading centre, founded by Louis VII. (1163) ; pop. 5000.

VILLERS-COTTERETS. A town of France, in the department of Aisne ; the junction for Compiègne, Pierrefonds, and La Ferté Milon, on the Paris-Soissons line (Northern Railway). It is especially noted as the birth-place (1885) of Dumas *père*, and is dealt with at length in his *Memoirs* (English translation in 6 vols.). Pop. 6000.

VILLON, François. One of the greatest of the French lyric poets of the modern school, born at Paris in 1431, died probably in 1485. His real name was François de Montcorbier, but he adopted the name of his guardian, Guillaume de Villon, a priest. Educated at the University of Paris, he graduated bachelor of arts in 1449, and master in 1452, but fell into a disreputable way of living, and was more than once under sentence of death for his crimes. He was again under sentence of death in 1462, but his sentence was commuted to banishment.

Villon's works include *Le Petit Testament* (1456), a poem in 40 stanzas ; *Le Grand Testament* (1461), a poem in 173 stanzas ; and numerous ballads. The *Grand Testament* reflects most vividly the whole range of Villon's life, depicting his joys and sorrows, his misdeeds and remorse, and is distinguished by humour, sincerity, feeling, and poetical power. Villon's poetry is intensely subjective, and on account of his frankness and sincerity his writings may be considered as a fairly trustworthy picture of his ti The first edition of his works appe in 1489, whilst one of the best re editions is that of Longnon (P 1892).—BIBLIOGRAPHY : G. P *François Villon* ; R. L. Steven *Familiar Studies of Men and Boo*

VILNA (Lith. *Vilnius*). Capita Lithuania ; the railway centre of country, on the Leningrad-War trunk line, and lines to Eydtkuh (for Berlin) and Rovno (in the Po county of Wolyn). Trade is mai in wood and grain, and manufactu include leather and alcohol. mean annual temperature is 43·5° (January, 22° ; July, 64·5°), rain about 22 inches. Pop. estimated 197,000 (largely Jewish). It ninth town of Imperial Russia point of population.

First mentioned in 1128, Vi was, from 1322 to 1795, capital Lithuania, and here Yagello, nev converted to Christianity, erect the first Lithuanian cathedral (138 Alexander I. founded a universi (1576), which was suppressed in 18 after the Polish insurrection, Lith ania having been added to Russia 1795. Napoleon occupied the to in 1812.

During the European War (q. Vilna fell to the Germans on 18 Sept., 1915, and on the break-up the Russian Empire its possessi was disputed by the Poles and t Letts, the former claiming the tow on ethnic grounds, and the latter those of Lithuanian history. In Oct 1920, the Poles occupied the tow and the matter was finally submitte to the League of Nations for settl ment, the Lithuanian capital bein temporarily set up at Kovno. It h a broadcasting station (563 m., 16 kw. *See* LITHUANIA.

VIMEIRO (vi-mā'i-rų). A villag of Portugal, in Estremadura, nea Torres Vedras. It is remembered a the scene of the battle between Wel lington and Junot (21st Aug., 1808) which was followed by the Conven tion of Cintra (30th Aug., 1808). Pop 700.

VINCENNES. A town of France in the department of the Seine, about 2 miles east of Paris, of which it forms an eastern suburb. Its large old castle was once the residence of the French kings, but was converted into a State prison by Louis XI. A new fort and an arsenal were constructed between 1848 and 1852. After the siege of Paris by the Germans, Vincennes was occupied by the Communist troops, but it surrendered to the Versailles troops (28th May, 1871). Pop. 41,500.

VINCENNES. A city of Indiana, United States, the county seat of Knox county, on the Wabash River; a railway centre on the Vandalia, Baltimore, & Ohio, and other railways. It is also an industrial centre. Founded in 1731 as a French fort, Vincennes was territorial capital between 1800 and 1813, and finally became a city in 1856. Pop. 17,564.

VINCENT, John Jervis, Earl of St. British admiral, born 1734, died 1823. He entered the navy at an early age, and commanded the *Foudroyant* in the action between Admiral Keppel and the French fleet in July, 1778. In 1794 he commanded a squadron in the West Indies, and reduced Martinique, Guadeloupe, and St. Lucia.

On the 14th Feb., 1797, in command of the Mediterranean squadron of fifteen sail, he defeated twenty-seven Spanish ships of the line off Cape St. Vincent, and was created a peer with the title of Baron Jervis and Earl of St. Vincent, and was granted a pension of £3000 a year. In 1799 he became admiral, in 1801 First Lord of the Admiralty, and in 1821 Admiral of the Fleet.

VINCI (vin'chē), **Leonardo da.** Italian painter, also distinguished as a sculptor, architect, civil and military engineer, and as a scientific inventor, was born at the village of Vinci, near Florence, in 1452, died in 1519 near Amboise, in France, where he is buried. He was the natural son of Pietro da Vinci, a Florentine notary, and as a boy displayed great talent in every direction, especially in drawing and modelling. His father placed him in the studio of Andrea Verrocchio, with whom he remained some years.

The small *Annunciation* in the Louvre, which belongs to this period, shows his master's influence, but also a grace and delicacy of Leonardo's own. Other early works, *The Adoration of the Magi* (Uffizi, Florence) and *St. Jerome* (Vatican), show how soon he broke away from the contemporary outlook and methods. To an early period also belongs the *Virgin of the Rocks* (Louvre), of which the National Gallery picture is probably a later version partly executed by another hand.

About 1482 Leonardo entered the service of Ludovico il Moro, Duke of Milan, who employed him in engineering as well as artistic work. In 1493 his model for an equestrian statue of Francesco Sforza was erected in the Castello at Milan; but no cast was ever made, and the model was afterwards destroyed, probably by the French.

Between 1496 and 1498 he painted the famous *Last Supper* in the refectory of S. Maria della Grazia at Milan. The original has almost disappeared; but what remains, with copies and engravings, show it to have been one of the most impressive renderings of the subject ever achieved. One of the best copies is at Burlington House, London, by Marco d'Oggiono. After the occupation of Milan by Louis XII. in 1499 Leonardo returned to Florence, where he painted the celebrated portrait of Mona Lisa del Giocondo, known as *La Gioconda*, now in the Louvre.

In 1502 he was appointed chief engineer and architect of the Papal army, and, after visiting many of the fortified places in the Papal dominions, returned to Florence in 1503. Here he was commissioned by the Signoria to produce a cartoon for a battle-piece to decorate the Sala del Consiglio. This, known as the *Battle of Anghiari*, with a corresponding cartoon by Michelangelo, were described by Benvenuto Cellini as "the school of the world," so widespread was their influence.

The fresco from the cartoon was begun but never completed; and its beginnings were covered by the later work of Vasari. In 1507 Leonardo was in Milan, and there probably painted *The Madonna and Child with St. Anne* (Louvre). In 1513 he visited Rome, and in 1516 accompanied Francis I. to France, where he died. To this later part of his life no existing work can definitely be ascribed.

Leonardo's writings include a *Trattato della Pittura*, first printed in 1651, which contains a mass of information on the principles and practice of painting, of which many subsequent writers have availed themselves. In 1797 some fragments of his mathematical writings were published in Paris, and created a profound sensation; and from 1880 to 1891 six volumes of miscellaneous manuscripts appeared, edited by M. Ravaisson.

Leonardo's painting was based upon profound theoretical study and scientific knowledge. He worked slowly and produced comparatively little. Yet there is no artist of his time who does not owe something to him.—BIBLIOGRAPHY: J. P. Richter, *Leonardo da Vinci*; Jens Thüs, *Leonardo da Vinci*; Eugene Muntz, *Leonardo da Vinci*.

VINDHYA. A mountain range of India, stretching east to west from the basin of the Ganges to Guzerat. It forms the northern boundary of the valley of the Nerbudda, and unites the northern extremities of the Eastern and Western Ghauts.

VINE. A well-known climbing shrub, type of the order Vitaceæ, which consists of climbing plants with woody stems, simple or compound leaves, peduncles sometimes changed into tendrils, small green flowers, and round berries. The species are found in both the Old and New Worlds, especially in Asia. The best-known and most useful of the order is the *Vitis vinifĕra*, the grape-vine, cultivated in the Old World from time immemorial, of which there are numerous varieties, distinguished by possessing lobed, sinuately-toothed, naked or downy leaves.

Several species of vine are indigenous in North America, as the *Vitis*

Vine

Labrusca, the wild vine or fox-grape; *V. cordifolia* or *riparia*, heart-leaved vine, river-side vine, or frost-grape; and *V. æstivālis*, the summer grape. The vine grows in every sort of soil, but that which is light and gravelly is best suited for the production of fine wines. It is a long-lived plant; indeed, in suitable climates the period of its existence is not known. It is propagated from seeds, layers, cuttings, grafting, and by inoculation, the first method being used for obtaining new varieties. *See* PHYLLOXERA; OĬDIUM; RAISINS; CURRANT; WINES AND SPIRITS.

VINEGAR. The sour liquid formed by the acetic fermentation of dilute solutions of alcohol. The sour taste is due to the presence of acetic acid (some 5 per cent) obtained by the oxidation of the alcohol by the action of certain bacteria. In wine countries it is obtained from the acetous fermentation of inferior wines, but in Britain and elsewhere it is usually procured from an infusion of malt which has previously undergone the alcoholic fermentation.

Vinegar is used in pharmacy for preparing many remedies, and externally in medicine, in the form of lotions. The use of vinegar as a condiment is universal. It is also used in making pickles.

VINEGAR-PLANT. A common name of Fungi and bacteria which are capable of fermenting sugary or alcoholic solutions with formation of acetic acid.

VIOLET (Viŏla). The popular name given to the species of the genus Viŏla, which are favourite flowers in all northern and temperate climates, and many of them among the first to make their appearance in the spring. The corolla is composed of five unequal petals, the anterior being spurred; the roots are mostly perennial; the leaves are alternate and stipulate; and the flowers are pedunculate.

More than a hundred species are known. The greatest favourites are *Viŏla odorāta*, or common sweet violet, and *V. tricolor*, or heart's-ease, the former being especially esteemed for its fragrance. The well-known pansies so common as garden flowers are but varieties of *V. tricolor* produced by cultivation.

VIOLIN AND VIOLIN-PLAYING. Musical instruments which are made to sound by means of the plucking or bowing of strings have been in use in one form or another since prehistoric times, and authorities disagree regarding the origin of the violin.

It is certain, however, that the immediate predecessors of the various members of the violin class were the viols. These instruments first came into use in the fifteenth century, and remained in favour for about three hundred years. They were made in four principal sizes—the treble or discant viol, the tenor (*viola da braccio*), the bass (*viola da gamba*), and the double bass (*violone*); the number of strings was usually six, and the tuning was by fourths, with one third between the third and fourth strings.

From these the model for the violin family was evolved by decreasing the depth, replacing the flat back of the viol by the curved or moulded back of the violin, and raising the shoulders of the body till they joined the neck at right angles, instead of flowing into it tangent-fashion, as was the case in the viol. The double-bass, alone of the violin family, has retained the flat back, the sloping shoulders, and the tuning

in fourths of the viol tribe, while adopting the moulded belly of the violin. Finally the number of strings was reduced to four and the tuning altered to a series of fifths.

Instruments on the new model were first made in Italy about the middle of the sixteenth century. Until recent times Gaspar Duiffoprugcar or Tieffenbrucker (1514-72) was regarded as the inventor of the violin, but latest researches tend to weaken his claim to that distinction.

Naturally the design and proportions of the perfect violin were not immediately discovered, and the subsequent changes were in matters of detail only. In the early days of Italian violin-making Brescia was the centre of the industry, and Gasparo da Salo and Maggini the principal makers, but it is with Cremona that all the greatest names are associated.

Four generations of the Amati family (q.v.) worked there. Guarnieri and Stradivari, by variations in detail, brought the violin to a stage of perfection. Practically no change has been made in the instrument since their time, and the violin as we have it now is substantially the violin of 400 years ago.

Bows were certainly in use before the thirteenth century, and all early examples were clumsy. François Tourte (1747-1835), by many important improvements, produced a bow worthy of the perfected form of the violin. His name, therefore, is of as great importance as that of Stradivari himself.

Violin-playing. The invention of the violin offered greatly increased opportunities to composers. Music for the viols had been written very much on vocal lines, as is shown by the phrase "apt for voices or viols." The history of violin-playing is really the history of violin-composition. Giovanni Gabrieli (1557-1613) was the first to show a decided instrumental sense in his writings, though he made only modest demands of the executant. Monteverde (1567-1643) made use in his music of *pizzicato* and the *tremolo*, and required definite gradations of tone from his players.

Violin solos were first written early in the seventeenth century, one of them introducing the shake for the first time. Very soon varieties of bowing, double stopping, arpeggios, chords, octave passages, and frequent changes of position were introduced, leading to the earliest examples of violin sonatas, which consisted of slow and quick movements alternately.

Corelli (1653-1713) was the greatest figure of the first period, summing up in his compositions all the best work of his predecessors. Tartini (1692-1770), great as performer, teacher, and composer, advanced the art of bowing. Paganini (1782-1840) finally demonstrated, in sensational fashion, the technical possibilities of the violin.

At the present day the general standard of violin-playing is very high, the string sections of symphony orchestras, particularly in this country, being composed of thoroughly equipped players whose great technical proficiency in successfully meeting the serious demands of the modern composer is not always sufficiently realised.

VIOLONCELLO. This member of the violin family has been derived from the bass viol or *viola da gamba* by the introduction of the same changes which evolved the violin from the treble viol, but the name describes it as the diminutive form of the *violone*, the contrabass viol, which is practically the modern double bass. This relationship still holds, for the violoncello is an octave higher in pitch than the double-bass. The four strings are tuned in fifths, an octave below those of the viola, the lowest note being C below the bass stave.

So far as can be discovered, Andreas Amati (1540-1600) was the first maker of the violoncello. The new instrument did not at once displace the viola da gamba. The special difficulties of fingering and bowing with regard to the instruments were systematically dealt with for the first time by J. L. Duport (1749-1819) in his *Essai sur le doigter du violoncelle et la conduite de l'archet*. The violoncello has a range of over three and a half octaves and a markedly characteristic and very beautiful quality of tone.

VIPER. A name applied to various venomous Old World serpents belonging to the family Viperidæ, suborder Viperinæ, and characterised, like other members of that section, by having no teeth in the upper jaw save the two hollow poison-fangs. The common viper or adder (*Vipera* or *Pelias berus*), the only venomous serpent which occurs in Britain, appears to be very local in its distribution.

It is generally of a brownish-yellow colour, with zigzag markings and black triangular spots. Its bite is, as a rule, not fatal, but may induce pain, sickness, and fever. The food consists of frogs, mice, birds, eggs, etc. The viper is viviparous—retaining its eggs within the body till the

young are hatched. Among other snakes denominated vipers are the African puff adder (*Bitis arietans*); horned viper or asp (*Cerastes cornutus*) of North-Eastern Africa, Arabia, and Palestine; and the daboia or Russell's viper (*Vipera russelli*), native to India, Ceylon, Burma, and Siam.

VIRCHOW (fĕr'*hō*), **Rudolf.** German scientist, born 1821, died in 1902. He studied medicine at Berlin, and early became famous as a lecturer on pathological anatomy at Berlin University. In 1849 he accepted a chair at Würzburg, where he remained seven years, returning to Berlin in the autumn of 1856 as professor in the university and director of the pathological institute attached to it.

Virchow rendered immense service to medical science by his discoveries in regard to inflammation, ulceration, tuberculosis, and numerous other morbid processes of the human body, and has had great influence on the whole of modern medicine, including hospital reform and sanitary science. Elected to the Prussian Diet in 1862, he became one of Bismarck's most powerful opponents. Among his many important works is *Cellular Pathology*. Most of his medical works have been translated into English.

VIRGIL (Publius Vergilius Maro). The national poet of Rome, born near Mantua on the 15th of Oct., 70 B.C., and died at Brundisium on the 21st of Sept., 19 B.C. The form Vergilius is supported by the ancient manuscripts and inscriptions in unbroken succession to the fourth century A.D., but for many centuries the name has been spelt with an "i" in all modern languages (e.g. "Virgilio" in Dante), so that it would be pedantic to write "Vergil" in English.

Virgil was almost certainly of Celtic extraction; the province of Italy in which he was born was only admitted to full Roman citizenship when he was twenty-one. His Celtic blood would account for the tenderness and melancholy of his writings. Virgil's father was, according to some accounts a potter, according to others the hired man of one Magus, an attendant on the magistrates. He married his master's daughter, and purchased woodlands and raised bees.

Virgil remained at Cremona until he was fifteen, when he went to Milan and thence to Rome. He lost his parents in his early manhood; his father had previously gone blind. Among other studies he gave attention to medicine and in particular to mathematics. He had some intention of practising as a barrister, but only conducted one case in court, as spoke slowly and with difficulty.

He began to write poetry when was still a boy, composing an epita on the master of a school of gla ators called Ballista. Then he wro some of his minor poems, proceedi to the composition of the *Bucolics Eclogues*, which he finished in thr years. The *Georgics* took seven yea and the *Æneid* twelve. When writi the *Georgics*, he dictated every day large number of verses which he ha composed in the morning, and spe the rest of the day in reducing the to a very small number. He use to say, with more wit than know ledge of natural history, that h licked his poem into shape, as a she bear did her cubs.

The *Æneid* was drafted first i prose, and divided into twelve books Virgil then turned into verse on part after another, as fancy guide him. In order not to interrupt th flow of his inspiration he left som things unfinished, and buttresse others up with slight words, which as he used to say, were put in lik props, to support the structure unti the solid columns should arrive.

In 19 B.C., wishing to give the finishing touches to the *Æneid*, he determined to go away to Greece and Asia, and, after devoting three entire years to the task of improving his poem, to give up the rest of his life wholly to philosophy. He returned from Athens with Augustus, but caught near Megara a fever which was aggravated by the journey, and died at Brundisium. He was buried at Naples, on the road to Pozzuoli.

In person, Virgil was tall and broad, with a dark complexion and a rustic appearance. His health was uncertain; he had stomach and throat troubles, sick headaches, and frequent hæmorrhages. He possessed nearly ten million sesterces given to him by his friends, and he had a house at Rome on the Esquiline, near the gardens of Mæcenas, although he usually lived in retirement in Campania and in Sicily. At Naples he was nicknamed "The Maiden" (cf. Milton, who was known at Cambridge as "The lady of Christ's"), on account of his modesty; and whenever he appeared in public in Rome he would take refuge in the nearest house, to avoid those who followed and pointed him out.

This account of Virgil has hitherto followed the short biography which is almost certainly by Suetonius. To it we may add that Virgil owed his worldly success largely to his friendship with Mæcenas and with the emperor. Horace and Virgil were intimate and affectionate friends

also; Horace mentions his friend eight times in his works, and accompanied him and Mæcenas on the journey to Brundisium (*Sat.* i. 5).

The pastoral poems, which are known indifferently as *Eclogues* or *Bucolics*, were published in 37 B.C. The collection consists of ten poems all more or less closely modelled on Theocritus (q.v.). There is an autobiographical element in some of these poems which has proved almost as baffling to commentators as the similar element in the *Sonnets* of Shakespeare. The fourth eclogue has attained a disproportionate celebrity because it was for long considered to be a prophecy of the coming of Messiah.

The sixth eclogue, which contains many reminiscences of Lucretius, is a good poem. The eighth is an imitation of the celebrated second idyll of Theocritus; the story has inartistically been given a happy ending. The remaining poems deal mainly with the commonplaces of pastoral poetry.

Virgil's *Eclogues* are the least mature of his poems, but they show many examples of the exquisite finish which he could give to his lines. They set the standard for pastoral poetry for many centuries.

Those who, like J. C. Scaliger, prefer them to the *Idylls* of Theocritus, might as well make a similar extravagant claim for Calpurnius Siculus, or the "good old Mantuan" whom Holofernes in *Love's Labour's Lost* so heartily commends.

Despite their felicities of metre and language, the *Eclogues* are feeble and artificial poems, a mere echo of the work of a poet who excelled in this kind of writing. In them Virgil shows, like Sir Toby Belch, "no respect of place, persons, nor time." Sicily and Lombardy, Virgil's friends and Arcadian shepherds, the reign of Ptolemy Philadelphus and the reign of Augustus are all indiscriminately mixed together.

The *Georgics* is Virgil's most finished and most characteristic work, and is the most polished and perhaps the most famous didactic poem in the world. It was inspired by the *Works and Days* of Hesiod (q.v.). Hesiod, though an interesting and important poet, owes not a little of his charm to his *naïveté*, to his lack rather than to his possession of artistic skill. Virgil was above everything an artist, so he imitated Hesiod in a different fashion from that in which he imitated Theocritus.

Virgil owed a debt also to Aratus, Cato, and Varro; but all that gives the poem its unique quality is his own. The first book deals with farming in general, the second with the growing of trees, the third with the rearing of cattle, and the fourth with bee-keeping. Virgil's object in writing the *Georgics*, however, was not to convey accurate information, but glorify labour, and to turn the thoughts of men to the advantages which the country has over the city.

It is probable that the poem was written in obedience to a wish of Mæcenas, expressed in order to further the emperor's agrarian policy; but it is no mere piece of propaganda, nor has it the appearance of having been written to order. It is filled with lofty patriotism. It certainly helped to revive some of the simple tastes and sentiments of the olden time.

The poem was written and revised with scrupulous care, at an average rate of less than a line a day. It owes its fame mainly to its finish and its lofty thought, but its message is not to be overlooked. That message is the same as that of *Candide*—"Il faut cultiver notre jardin."

The *Æneid* is the most important and most influential poem of Virgil's works, but there are reasons for believing that he undertook the composition of it with some reluctance. Suetonius says that he began to write of Roman legend, but, thinking himself unequal to the subject, turned to the *Bucolics*. Virgil hints at this incident in *Eclogue* vi. 3. The *Æneid* was a mirror, as it were, of both poems of Homer, books i. to vi. resembling the *Odyssey*, and books vii. to xii. the *Iliad*. It treated Greek and Latin personages and affairs in common, and contained at the same time an account of the origin of the city of Rome and of Augustus, which was the poet's special aim. It was therefore an official poem, and Æneas has something of that sacrosanctity which belongs to a state employee.

Before the poem was well begun Propertius hailed it as something greater than the *Iliad*. Virgil did not share his confidence or enthusiasm. He wanted to devote three years to polishing the poem, and requested his friend Varius to burn it should he die.

On his death-bed he would himself have destroyed it; and when he was not allowed to do so, he made Varius and Tucca his literary executors, on condition that they should publish nothing which he himself would not have given to the world. Varius, however, published the *Æneid* at Augustus's request.

Some parts of the *Æneid*, especially the battle-scenes, seem to have been written under the uncomfortable

necessity of producing what should please the emperor. In spite of these defects, the *Æneid* is not only one of the most famous but also one of the noblest poems in the world.

In the sixth book in particular Virgil has shown himself a real *vates*, the equal of Homer and of Dante. Besides being one of the world's great poets, Virgil is in a peculiar and intimate sense the national poet of Italy—as much as Burns is the national poet of Scotland. He is so mainly on the strength of the *Æneid*, which, if not a success as a whole, contains his most majestic passages.

The minor poems assigned to Virgil consist of the *Catalepton*, fourteen small poems, in various metres, some of which are perhaps the work of his 'prentice hand; the *Culex*, an epyllion, probably by a contemporary admirer of Virgil; the *Ciris*, almost certainly not by Virgil; the *Moretum*, possibly genuine and an early exercise in composition; and the *Copa*, a poem so un-Virgilian in style that it probably was not attributed to Virgil without good reason.

Virgil has never lacked detractors, even from the earliest days. One Herennius made an anthology of his defects, one Perellius Fausta gathered together his pilferings. Modern times have produced a fresh body of hostile critics. The common charge against Virgil is that he is artificial—as if all poetry were not artificial to a greater or a less extent. His works repay close study; he that runs may not read them. They display perfection and purity; Virgil shows himself when at his best as a man of a higher type, not even a little lower than the angels.

In the centuries following Virgil's death grammar became a religion and Virgil its high-priest—Musarum sacerdos. In the Dark Ages "all learning fell under suspicion, till at length the very grammar itself gave to English the word gramarye;" by a similar change Virgil turned into a great magician—the Merlin of the Roman Empire. He was credited with universal knowledge and ability to do everything. His works were ransacked (as those of Shakespeare sometimes are), not for their wisdom, but for the encyclopedic information which they were supposed to contain.

Mediæval legend which made Virgil a sorcerer is, however, less far astray than modern scientific criticism, which makes him a mere plagiary, just as the savage who worships the sun is in a more salutary frame of mind than the scientist who thinks that by means of the spectroscope he has plucked out the heart of the mystery of the solar system. Virgil himself used to say about his detractors: "Why don't my critics also attempt the same thefts? If they do they will realise that it is easier to filch his club from Hercules than a line from Homer."

In the happy passage in which he speaks of the *curiosa felicitas* of Horace, Petronius calls Virgil "Roman Virgil." The same phrase is used in Tennyson's noble *Lines to Virgil*, written at the request of the Mantuans for the nineteenth centenary of the poet's death. This poem is the finest tribute in English to the

> Wielder of the stateliest measure ever moulded by the lips of man.

BIBLIOGRAPHY: W. Y. Sellar, *The Roman Poets of the Augustan Age*; T. R. Glover, *Studies in Virgil*; F. W. H. Myers, *Classical Essays*; Sainte-Beuve, *Étude sur Virgile*; Patin, *Études sur la poésie latine*; Comparetti, *Vergil in the Middle Ages* (English translation by E. F. M. Benecke); J. W. Mackail, *Virgil and his Meaning to the World of To-day*. There is a famous translation by Dryden; Conington has translated the *Æneid* into octosyllabic verse, and the whole works into prose.

VIRGINAL. *See* PIANOFORTE.

VIRGINIA. A state in the South Atlantic division of the United States. It has a considerable seaboard, deeply serrated by drowned river-valleys, backed by a large coastal plain (*Tidewater Virginia*), which merges westwards with the submontane (*Piedmont*) region, that is, in turn entirely swallowed up in the Blue Ridge. Behind the Blue Ridge is the Appalachian zone, with its *valley*, the Shenandoah Valley or Valley of Virginia, drained by the Shenandoah.

Towns and Communications. Richmond is the state capital; other towns are Norfolk, Roanoke, Portsmouth, and Newport News. There were, in 1932, 4491 miles of steam and 541 miles of electric railway track, the chief lines being Seaboard Air, Atlantic Coast, Chesapeake & Ohio, and Southern.

People. In 1930 1 per cent of the population was foreign-born; and of 23,820 (approximately) foreigners, about 3088 were English, 2989 (or 12·5 per cent) Russian, and 2505 German. Other nationalities were Irish and Scots. About 26·8 per cent of the total population is negro.

Production. Virginia is a great cotton-producing and manufacturing State, but the leading manufacture is tobacco. Peanuts are graded, roasted, and shelled, and iron, paper, pulp, glass, leather goods, etc., are made.

There are valuable oyster and other fisheries. Minerals worked include coal, copper, granite, lead, gold, and gypsum, and there are many mineral springs in the Appalachian region, some of them thermal (as at Hot Springs, 110° F., and Healing Springs, 90° F.).

Education, etc. Education is free and compulsory between the ages of eight and twelve years; the colour bar is rigid, and white children are strictly segregated from black. There are schools of theology, law, medicine, dentistry, etc., a State university, and many colleges. Area, 42,627 sq. miles (2365 sq. miles being water); pop. (1930), 2,421,851.

Constitution. Virginia was one of the original thirteen States of the Union. For local government purposes there are 100 counties. The central government or General Assembly is bicameral, comprising a Senate (40 members, elected for four years) and a House of Delegates (100 members, elected biennially). Two Senators and 9 Representatives are sent to Congress.—BIBLIOGRAPHY: T. J. Wertenbaker, *Virginia under the Stuarts*; J. E. Cooke, *Virginia: a History of the People* (American Commonwealths Series).

VIRGINIAN CREEPER. The *Parthenocissus quinquefolia*, a climbing plant, native to North America, used as an ornamental covering for walls, etc., and sometimes called *American Ivy*. Its leaves turn a bright red in the autumn.

VIRGIN ISLANDS. An archipelago of the West Indies, divided between Great Britain and the United States; area, 465 sq. miles.

British. Thirty islands are British; area, 58 sq. miles; pop. 5082. Tortola, the largest, contains Road Town (pop. 463), the only town and seaport. Other islands are Virgin Gorda, Anegada, and Jost van Dyke. The group forms one of the five Presidencies of the Leeward Islands, and is governed by a nominated Executive Council. Cotton and sugar are the chief products. Sombrero, an outlying island maintained as a lighthouse, is administered by the Presidency.

United States. Over 100 islands are American; area, 133 sq. miles; pop. (1930), 22,012. St. Croix (82 sq. miles; pop. 14,901; towns Christiansted, pop. 3767, Frederiksted, pop. 2698), St. Thomas (28 sq. miles, pop. 10,191; town, St. Thomas, pop. 7036), and St. John (20 sq. miles, pop. 959) are the principal islands. In 1916 the Danish West Indies were purchased by the United States, and government was organised on a municipal basis, a Colonial Council governing each municipality under the Governor. There are two Municipalities: (1) St. Croix (Council of 18), (2) St. Thomas and St. John (Council of 15). The Governor has a Cabinet of six portfolios.

VIRTON. A town of Belgium, in the south of the province of Luxembourg. It is an educational centre, with a tanning industry and a trade in wood. In 1914 (European War) Virton was the scene of desperate Franco-German engagements. Pop. 3000.

VIRTUAL WORK, or VIRTUAL VELOCITIES, PRINCIPLE OF. This refers to a method of solving problems in the statics of connected systems. A *virtual displacement* is any small displacement consistent with the mechanical connections. The *virtual work* corresponding to such a displacement is the work done by the forces actually applied to the body or system while the displacement takes place, each force remaining unaltered in direction and magnitude.

The *principle of virtual work* asserts that if a system is in equilibrium under any forces, the algebraic sum of the amounts of virtual work done by all the forces must be zero (more strictly, must be of an order of smallness higher than that of the small displacement). A simple example of the application of the method is furnished by the lever, where the work done by the "effort" is equal and opposite in sign to that done by the "load" when a small rotation about the fulcrum takes place.

The *principle* was first studied by the French mathematicians. Lagrange used it as the basis of his great treatise *Mécanique Analytique*. Thomson (Kelvin) and Tait gave a proof based on the principle of conservation of energy. Since D'Almbert's principle makes the equations of motion of a system depend on the principle of statical equilibrium, the application of the principle of virtual work extends to kinetics. This application led to Lagrange's generalised methods in dynamics. A full account of "virtual work" is given in E. J. Routh's *Analytical Statics*.

VISCACHA (vis-kä'chà; *Lagostómus trichodactylus*). A rodent mammal of South America, allied to the chinchilla, about 2 feet long and stoutly built, with a short tail, inhabiting the Argentine pampas, and living in burrows.

VISCOSITY. A kind of internal friction opposing relative shearing motion of the parts of a body. Viscosity is shown in a certain degree by

every sort of material, but it is most important in liquids. Its intensity is measured by the *coefficient of viscosity* (*see* HYDRODYNAMICS). The property is quite distinct from elasticity of shape, in which fluids are entirely lacking. The resistance of an elastic body to change of shape depends on the *amount* of the change, whereas viscous resistance depends on the *rate* at which the change takes place. The coefficient of viscosity of a liquid is usually determined by measuring the volume of liquid which flows through a capillary tube, and applying Poiseuille's formula $\pi Pr^4t/8lV$ for the coefficient, where P is the difference of pressure between the two ends of the tube, r its radius, l its length, and V the volume of liquid delivered in time t. The coefficient depends to a marked extent upon the temperature, decreasing rapidly, as a rule, as the temperature rises. The following are some values in C.G.S. units: at 20° C., ether 0·003, water 0·01, glycerine 8·5; at 8° C., shoemaker's wax $4·7 \times 10^6$; at 15° C., air 181×10^{-6}.

VISCOUNT (vī'kount). A title of nobility next in rank to that of earl, and immediately above that of baron. It is the most recently established English title, having been first conferred by letters patent on John, Lord Beaumont, by Henry VI. in 1440. The title is frequently attached to an earldom as a second title, and is given by courtesy to the eldest son of the earl.

VISHNU (the Preserver). The second god of the Hindu triad, but considered by his worshippers as the greatest. He is always becoming incarnate to oppose the power of the demons, to restore the authority of the gods and effect a beneficial change in the government of the universe. His descents are called *avatars*, or incarnations, and are regarded as innumerable, although ten special avatars are given. He is generally represented as having four arms, and as riding on the Garuda, a being half man and half bird.—Cf. W. J. Wilkins, *Hindu Mythology*.

VISIBILITY. The state of the atmosphere in regard to the ease with which objects at a distance can be discerned. Visibility is impaired by the presence in the air of foreign particles, which both intercept light rays and produce a general scattering or diffusion of light, tending to hinder the discrimination of light and shade. The foreign matter partly consists of molecules of hygroscopic substances. Though of almost perfect transparency when the air is dry, under humid conditions they attract water and diminish visibility.

Other foreign particles are s and relatively heavy. These furnish nuclei for the condensat of vapour, and thus dense fogs often produced in cities from numerous soot and dust partic Even without attracting aque vapour, dust particles sometin cause dense obscuration from th mere abundance and opacity, as tropical dust-storms.

In certain unstable types of press distribution, such as "wedges" a straight isobars, the weather may temporarily fine, with dry and tra parent air, a condition soon to gi place to a barometric depression a rainfall. On this account mark visibility, or "distant hills seemi nigh," although in general indicati present dryness of the atmospher is often quoted as foreboding t approach of rain.

VISION. *See* EYE; LENS; LIGH

VIS'TULA (Pol. *Wista*; Ge *Weichsel*). A river of Poland, risin in the Carpathians, and emptyin into the Gulf of Danzig after a cours of about 650 miles. Its delta is withi the territory of the City of Danzi (q.v.). The actual outlet of the Vis tula is an artificial one which wa cut in 1895 between Einlage and Schiewenhorst. The Elbing Vistul (16 miles long; Elbing to Frische Haff) and the Danzig branch o "Dead Vistula" are used as canals, and the Nogat (*see* PRUSSIA, EAST) is controlled from the head of the delta at Pieckel (32 miles from the sea). The fall of the Vistula is only 1 in 5625 above Pieckel and 1 in 5886 on the delta. The name adopted here and generally used in English is the Latin one. *See* POLAND.

VITAMINS. As biochemists improved their technique for the purification of the components of elementary foodstuffs, they naturally wondered whether animals could be satisfactorily nourished on diets of their chemically pure products. Experiments soon showed that adequate amounts of pure proteins, carbohydrates, fats, and salts were not of themselves sufficient to maintain health in the adult and promote growth in the young, but that this deficiency could be rectified by the addition of minute amounts of certain natural foods. Further, the symptoms developed and the similarity of the remedial agents revealed a close connexion between the condition of these inadequately fed animals and certain human diseases, e.g. scurvy, which had long been known empirically to be curable by

:e small dietary changes. The
s name of vitamins has been given
these remarkable diet-supple-
nting substances. Up to the pre-
t, six vitamins have been clearly
inguished, while several others
'e been described.

Vitamin A is synthetised by the
mal liver from the plant pigment
otene. Its absence from the diet
ibits growth of the young animal,
l, at any age, induces a drying and
dening of the tissue lining the
mentary, respiratory, and genito-
nary tracts, the eye, and certain
nds. The changes in the eye pro-
ce the characteristic disease of
iry-eye", while the increased lia-
ity to infection which appears in
imals deprived of vitamin A is
obably due to the absence of the
otective barrier of a normal lining
many of the internal organs. Rich
tural sources of the vitamin are
een vegetables, carrots, tomatoes,
id cod-liver oil.

Vitamin B_1 is also essential for
owth. Its absence from the adult
et leads to the appearance of beri-
ri, a disease prevalent among
astern peoples living almost exclu-
vely on polished rice. In the process
! polishing, the vitamin, which is
resent in the germ and pericarp of
ie grain, is removed. The disease
an be rapidly cured by adminis-
ering an extract of the polishings.

Vitamin B_2 in its natural distri-
ution is almost identical with B_1.
t is also necessary for growth, and
s absence from the diet has some
elation to the incidence of pellagra,
disease of wide distribution occur-
ing, for the most part, in popula-
ions living largely on maize. The
xact relation between pellagra and
Vitamin B_2 is, however, less defined
han that between beri-beri and B_1.
Yeast, cereal germs, eggs, and liver
are all rich sources of both B_1 and
B_2. The growth-promoting proper-
ties of yeast and cereals would appear
to involve other vitamins, which have
been labelled B_3, B_4, etc.; these are
as yet too ill-defined for discussion
here.

Vitamin C, which protects against
scurvy, is present in many fruits and
vegetables, the most convenient
sources being lemon or orange juice
and tomatoes. On account of its
special susceptibility to oxidation,
it is destroyed in the processes of
cooking and milk-pasteurisation.

Vitamin D remained for long un-
distinguished from A, to which its
distribution is similar, though more
restricted. Its deficiency impairs the
proper utilisation of the lime and
phosphorus of the food, and hence is
the main if not the sole factor in the
production of rickets. The richest
natural sources are the oils of cod
and other livers, but it can be
generated in almost any foodstuff by
irradiation with ultra-violet light.
Since it can also be synthetised in the
animal's skin by ultra-violet radia-
tion, rickets may be cured and pre-
vented either by administration of
the ready-formed vitamin in cod-
liver oil or by adequate exposure to
sunlight or to an artificial source of
ultra-violet rays.

Deficiency of vitamin E leads to
interference with the reproductive
process in both male and female rats.
As yet there is little evidence of its
necessity for other species. It is widely
distributed throughout the vegetable
dietary constituents, in which it is
intimately associated with their oils.

The minute amounts in which
these remarkable substances occur in
foods, and in which they are effec-
tive in promoting growth and main-
taining health, has rendered their
chemical purification and isolation a
matter of great difficulty. By arduous
and painstaking research, vitamins
D and C have now been isolated as
pure substances and the chemical
nature of A and B is all but com-
pletely known.

In assessing the importance of
vitamin deficiency as a cause of
disease, it should be remembered that
the diseases mentioned above are the
results of gross lack of the vitamin
concerned, a lack which would occur
only through poverty or exceptional
circumstances. On the other hand,
there are many who believe that
minor degrees of deficiency are rela-
tively common and are responsible
for much ill-health at present attri-
buted to other causes.

VITEBSK. A government of the
Russian Republic, bordering the
Latvian frontier and the Polish
Corridor. Area, 15,591 sq. miles
(1923); pop. (estimated), 1,500,000.
It is generally hilly, and in the de-
pressions lie innumerable lakes (Os-
veya, Nescherda, etc.) and extensive
marshes. The Dvina, connected by
the Berezina Canal with the Dnieper,
is the chief river.

Agriculturally the government is
poorly developed, but cereals and
flax are produced. Manufacturing
industries are at their nadir. Vitebsk
is the capital; other towns are
Polotsk (q.v.), Sebezh (pop. 5000;
on Sebezh Lake: the frontier station
on the Moscow-Windau & Riga Rail-
way), Nevel, and Lepel (9000; on
Lepel Lake).

Originally part of the principality
of Polotsk, Vitebsk became a sepa-
rate principality, was annexed to

Lithuania in 1320, and subsequently merged in Poland, from which it passed to Russia during the first partition (1772).

VITEBSK. A city of Russia, capital of the government of Vitebsk, on the Dvina; served by the trunk lines from Leningrad and Riga. It is largely Jewish. There are flax-spinning industries, and a brisk trade is carried on. The mean annual temperature is 40° F. (January mean, 16° F.; July mean, 64.5° F.). Pop. 98,857.

VITELLIUS, Aulus. A Roman emperor, remarkable only for his gluttony. He was appointed commander of the legions in Lower Germany by Galba, and on the death of the latter he was proclaimed emperor by his troops (26th Jan., A.D. 69). Six months later Vespasian was called to the throne, and Vitellius was deposed and executed (22nd Dec., 69).

VITER'BO. A city of Italy, in the province of Rome. It has an old Romanesque cathedral. Pop. 25,000.

VITI LEVU. *See* FIJI.

VITO'RIA, or **VITTORIA.** A city of Spain, capital of the province of Alava; a junction for Salinas de Leniz (12 miles), on the trunk line Irun-Madrid. Here, on 21st June, 1813, Wellington defeated the French under King Joseph and Marshal Jourdan. Pop. (1931), 40,942.

VITRIFIED FORTS. The name given to certain prehistoric hill-fortresses found in Scotland, Ireland, and the continent of Europe, and formed of stones heaped together. The materials of which they are constructed are perfectly or partially vitrified or transformed into a kind of glass by the action of heat. It is now generally believed that the vitrifaction was intentional, being effected by means of piled-up fuel.

VITRUVIUS POLLIO, Marcus. A celebrated Latin writer on architecture, who flourished in the time of Julius Cæsar and Augustus, and wrote his work *De Architectura* probably about 13 B.C. This treatise is valuable as a compendium of those of numerous Greek architects.

VITRY-LE-FRANÇOIS. A town of France, in the department of Marne, on the Marne; an important junction on the main line Paris-Sarrebourg, for Chaumont (63 miles; on Paris-Basel line), and minor branches to Sezanne (44 miles) and Bar-sur-Aube (40 miles). It is also the starting-point of the Marne-Rhine and Marne-Saône canals, has a Chamber of Agriculture, manufactures cement, carries on iron- and bell-founding and tanning, and has a trade in cereals, wine, wood, and wool. Pop. 9000.

VITTORIA. A town of Sicily, in the province of Syracuse; served by the railway from Syracuse to Licata. It has the largest Sicilian wine-market, and has oil and wine industries. The name honours the son of Vittoria Colonna, who founded the place in 1605. Pop. 32,000.

VITTORIO. A town of Venetia, North Italy, in the province of Treviso; served by a branch railway (9 miles) to Conegliano (on the trunk line Venice-Tarvisio). It is a sericultural centre which was formed by the amalgamation of the two towns Ceneda and Serravalle, the present name being adopted in honour of Victor Emmanuel I. Pop. 24,000.

VIVER'RIDÆ. A family of carnivorous mammals, including civet-cats, genets, and allied forms.

VIVIANITE. A translucent indigo-blue or bluish-white mineral, occurring in blade-like crystals in association with iron sulphides in veins, and consisting of hydrous iron phosphate. It also forms blue powdery crusts on the surfaces of bones entombed in bogs, as a result of reaction between calcium phosphate and salts of iron. The iron phosphate widely diffused in soils is probably vivianite.

VIVIPAROUS PLANTS. Those the seeds of which germinate while still attached to the parent plant, a condition seen in its typical form in Rhizophora and other mangroves. This is true viviparity, but the term is more often applied to that form of vegetative propagation in which flowers are replaced by bulbils, a common feature in alpine plants.

VIVISECTION. The name given by its opponents to operation upon living animals in the course of scientific research. In Great Britain, excepting the Channel Islands and the Isle of Man, vivisection is illegal unless conducted under licence from the Home Office. Licences are granted to individual experimenters for the conduct of experiments at specified places which are liable to visitation and inspection by Government officials.

No licence, however, covers every variety of experiment or species of animal, so that, in addition to his licence, an experimenter must possess himself of one or more of several certificates if he wishes to do more than operate under a general anæsthetic without allowing the animal to recover.

The Act of Parliament is involved and vexatious; but experimenters

longer urge or desire its amendment, since its provisions once understood give fair liberty in practice. Supported in this country by a few publicists of ability and popularity, the anti-vivisection movement advanced to a legislative success still unattained in Continental countries and America. There is much that is anomalous in the legal situation in Great Britain.

VIZAGAPATAM'. A town of British India, Madras Presidency, at the entrance of the Veragatam into the Bay of Bengal. It is a military station, and has a good harbour. Pop. 54,711.

VIZIER (Ar. *wazîr*, a bearer of burdens). A title given to high political officers in the Turkish Empire and other Mahommedan states. In Turkey the title is given to the heads of the various ministerial departments into which the Divan or Ministerial Council is divided. The President of the Divan, or Prime Minister, is known as Grand Vizier, *vizier-azam* or *sadr-azam*.

VLAAR'DINGEN. A town of the Netherlands, province of South Holland, on the New Maas, a seat of the Dutch herring-fishery. Pop. (1932), 28,194.

VLADIKAV'KAZ. A town of the North Caucasian Area, U.S.S.R., the chief town of Ciscaucasia and the capital of the former government of Terek, on the Terek. It is an agricultural centre, and has tanning, soap- and candle-making, brewing, and other industries, as well as a brisk transit trade over the Caucasus. Horses are raised in the district, and zinc-blende is worked. The altitude is 2345 feet, and the mean annual temperature 47·7° F. (January mean, 23° F.; July mean, 69° F.). April to September is the wettest period. Pop. (1926), 78,347.

VLADIMIR (vlâd-ē'mĕr). A former government of Russia. Area, 18,800 sq. miles; pop. 1,942,000. It is drained by the Oka and its tributary the Kliasma. There are important manufactures of linens and woollens, and several blast-furnaces.

VLADIMIR. One of the oldest towns in Russia. It has a cathedral, a theological seminary, considerable manufactures, and a trade in fruit. During the thirteenth century it rivalled Moscow in importance, but began to decay in the following century. Pop. 35,000.

VLADIVOSTOK. The chief port of the Far Eastern Area of Siberia, formerly the chief Russian naval port in the Pacific; the terminal of the Usuri and Manchurian Railways, running respectively to Khabarovsk and Harbin. A modern town, Vladivostok was founded in 1860, and is an ice-free port on Peter the Great Gulf. The mean annual temperature is 40° F. (January, 5°; August, 69·4°), rainfall 14·7 inches (mainly in August). Pop. 128,600.

VOI. A place in Kenya Colony, the junction for Moshi, on the Mombasa-Nairobi railway. Moshi is in Tanganyika Territory and on the Arusha-Tanga railway.

VOICE. *See* SINGING; LARYNX.

VOLAPÜK (vō'la-pük). The name given to a universal language invented in 1879 by Johann Martin Schleyer (born 1837), of Constance, after twenty years' labour. The name means "world-speech," being based on English *world* and *speak*, and a number of the vocables are modified English words.

In structure the language is simple and extremely regular, and the orthography is entirely phonetic, the words being pronounced as they are written, and vice versa. The vocabulary consists of about 15,000 words. The study of Volapük for a time made rapid progress; periodicals were written in it, and associations were devoted to spreading it; but it declined after 1890.

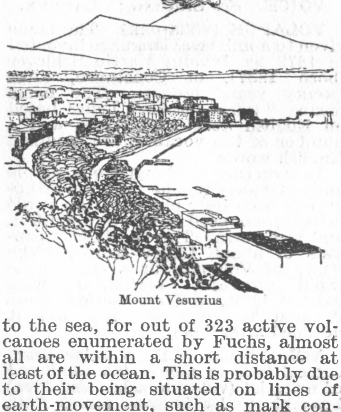
VOLCANOES. In a popular sense, conical hills or mountains composed of material (volcanic ashes and lava) brought up by igneous forces from the interior of the earth through a pipe or vent. The orifice is a cup-shaped hollow called the crater, which is sometimes due to explosion, and sometimes to the building of a ring round the vent by the products brought up from below. A volcanic eruption generally commences with the discharge of immense quantities of gases. This is followed by the ejection of "ashes" and hot fragments of rock. Lastly there is a flood of molten rock or lava.

Volcanoes which show such outbursts more or less frequently are called *active* volcanoes; those which are known to have been active in historic times, but have long been quiescent, are called *dormant* or sleeping volcanoes; and those which present all the phenomena of volcanoes, but which have shown no activity in historic times, are called *extinct* or dead volcanoes.

The mud volcanoes or *salses* of New Zealand, Burma, and elsewhere (conical hills of slowly flowing mud); the *fumaroles* (fissures from which steam issues); the *solfataras* (holes from which sulphurous fumes proceed)

of Italy, etc.; the geysers and hot springs of Iceland, New Zealand, the Yellowstone Park, etc., are signs of weak or decreasing volcanic activity in the special districts in which they occur. Volcanoes may occur as isolated conical mountains, such as Vesuvius, Etna, or the Peak of Teneriffe. They also form various groups or systems of mountains.

One remarkable fact in the distribution of volcanoes is their proximity



Mount Vesuvius

to the sea, for out of 323 active volcanoes enumerated by Fuchs, almost all are within a short distance at least of the ocean. This is probably due to their being situated on lines of earth-movement, such as mark continental margins or the floors of sinking areas. There are certain regions over the whole of which active volcanic vents are distributed at intervals.

Of these great regions that of the Andes is one of the best defined. An almost uninterrupted line of volcanoes stretches from the 46th degree of S. lat. in Chile to the north of Mexico, including Tunguragua, Cotopaxi, Antisana, Pichincha, Orizaba, Popocatepetl, Jorullo, etc.

Another continuous line of volcanic action commences in the north of Alaska, passes through the Aleutian Isles over to Kamchatka in North-Eastern Asia, then proceeds southward without interruption through a space of between 60° and 70° of latitude to the Moluccas. It includes the Kurile, Japanese, and Philippine Islands, traverses Java, Sumatra, Borneo, Celebes, and New Guinea, and extends to various parts of the Polynesian Archipelago and New Zealand.

In the Old World the volcanic region extends from the Caspian Sea to the Azores, embracing the greater part of the Mediterranean and especially some of its islands. Here volcanic action is most prominently visible in Vesuvius, Etna, and the Lipari Islands. Among disconnected volcanic groups may be mentioned Iceland (Mount Hecla, in particular), the Hawaiian Islands, Réunion or Bourbon, and Martinique and St. Vincent, in the West Indies, where an outburst in 1902 caused most lamentable destruction of life and property (*see* VESUVIUS; ETNA; HECLA; KRAKATOA; etc.). Submarine volcanoes have left numerous traces among stratified rocks, but such as are active at the present day are inaccessible.

In the nineteenth century several instances of the rise and disappearance of islands owing to volcanic action have been observed. Various theories have been proposed to account for the immediate cause of volcanic action. It is now generally accepted that it is produced by internal heat at a certain depth beneath the surface of the earth, and the evolution of a great body of elastic vapour, mostly steam, expanding and seeking to escape where the least amount of resistance is presented, and manifesting itself in the explosions that accompany an eruption, or in the upheaval of rocks and the production of earthquakes. While the molten contents of an igneous cauldron solidify in the earth, sufficient gas may be given off to shatter overlying rocks and clear a passage for eruption. *See* EARTH; GEYSERS; EARTHQUAKES; etc.

VOLE (Arvicŏla or Microtus). A genus of rodents closely allied to the rats and mice, and included in that family. There is a short hairy tail, and the crowns of the back teeth possess grinding surfaces with triangular projections. Some are terrestrial, others aquatic. The common

Field Vole

vole of Britain (*A. agrestis*), the meadow-mouse or short-tailed field-mouse, is injurious to young plantations and pastures, sometimes appearing in immense multitudes.

It is reddish-brown above and grey below. The water-vole (*A. amphibius*) or water-rat is much larger, and swims well though its feet are not webbed. It is of a pale- or chestnut-brown,

tinted with grey. A black variety of the water-vole is common in Britain. There are many other species of voles in the Old and the New World.

VOLGA. A river in Russia, the longest in Europe, rising in a small lake in the east of the Valdai Hills, and falling into the Caspian Sea by about seventy mouths, near Astrakhan, after a total estimated course of 2200 miles. Its basin is estimated at from 500,000 to 700,000 sq. miles. It flows generally south-east past Tver, Yaroslav, Kostroma, and Nijni-Novgorod to Kazan, thence south past Simbirsk and Saratov, and proceeds south-east from Sarepta to the Caspian.

Its chief tributaries are the Kama on the left bank and the Oka on the right. It is navigable by barges from its source, and communicates with the Black, Baltic, and Polar Seas by a series of canals. Its banks are fertile and well-wooded, and its waters abound in fish, particularly sturgeon, carp, and pike of extraordinary size.

VOLHYN'IA. A former government in South-West Russia. Area, 27,800 sq. miles; pop. 4,200,000. In the region all kinds of grain, but particularly wheat, are produced, and fine breeds of cattle and horses are reared. The hills in the south are rich in iron, and there are considerable manufactures.—The new government of Volhynia forms a division of Ukraine. Area, 12,021 sq. miles; pop. 1,404,769.

VOLOG'DA. A former government in North-East Russia; area, 155,500 sq. miles. Its forests furnish quantities of timber and charcoal. Pop. 1,679,000. The capital is Vologda, on a river of the same name, 35 miles E.S.E. of Leningrad. Pop. 39,000.

VOLOS. A town and seaport of Greece, at the head of the Gulf of Volos; served by the Thessalian Railway to Larissa and Kalabaka. It is the outlet for the cattle of Thessaly, which are exported to the Piræus, and for the chrome ore and other minerals of the region. Salt is worked in the vicinity. Pop. 30,100.

VOLSCI (vol'si). An ancient Italian tribe who dwelt in Latium, on both sides of the River Liris (Garigliano). Their principal city was Corioli, from which Coriolanus derived his surname. After having several times endangered the Roman state they were conquered, and disappeared from history (383 B.C.).

VOLT. The practical unit of electromotive force or electrical pressure. It is defined in relationship to the unit of current (ampere) and unit of resistance (ohm), both of which admit of exact definition in terms of physical dimensions and actions (*see* ELECTROLYSIS; OHM); viz. the volt is that electrical pressure which would cause the flow of one ampere through a resistance of one ohm. The absolute electromagnetic, or C.G.S., unit of pressure is the difference of potential between the ends of a straight conductor 1 cm. long which moves at the rate of 1 cm. per second in a magnetic field of unit strength, the field, direction of motion, and length of the conductor being mutually at right angles.

From this the definitions of the absolute C.G.S. units of current and resistance are obtained by using Joule's Law of Heating (*see* ELECTRICITY, paragraph on *Effects of an Electric Current*) and Ohm's Law in their simplest forms. Another method of defining these absolute units is to begin with the absolute unit of current (defined in ELECTROMAGNETISM) and again use Joule's and Ohm's Laws to derive the other two units. The ampere, volt, and ohm are, respectively, $\frac{1}{10}$, 10^8, and 10^9 of the absolute units.

VOLTA, Alessandro. Italian physicist, born at Como in 1745, died there in 1827. Two treatises, published in 1769 and 1771, in which he gave a description of a new electrical machine, laid the foundation of his fame. He was successively professor of physics at the Gymnasium in Como and in the University of Pavia, where he invented the electrophorus and electroscope. He also devised several other electrical appliances, and in 1800 the voltaic pile (q.v.).

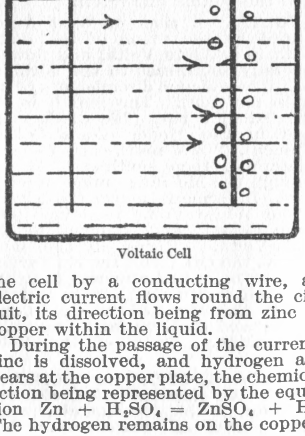
VOLTA. A river of West Africa formed by the union of the Black Volta and White Volta, and flowing generally south-east to the Bight of Benin, to which it disembogues below Adda (or Ada). The mouth is obstructed by a bar. The Black Volta rises in the Upper Volta Colony (French), flows north-east to near Kintampo, then south-east to cut through the hill range upon which it rises. It formerly joined the Niger.

The White Volta rises in Upper Volta Colony, and is joined by the Red Volta. Rising in the same colony, the Oti forms the chief tributary of the united stream. Both Oti and Volta fisheries are important. Nearly the whole of the Gold Coast Colony and its hinterland belongs to the drainage basin of the Volta system.

VOLTA EFFECT, or CONTACT E.M.F. An electrical effect observed by Volta, in which two metals, having been placed in contact, and then

separated, are found to be at different electrical potentials, the potential difference being known as contact E.M.F. Metals can be arranged in a series such that any metal is positive to the next metal in the series, e.g. zinc, lead, tin, iron, copper, platinum, carbon, the zinc being electropositive to lead, lead positive to copper, etc. According to Volta, the potential difference between two metals was caused by their contact alone, but this explanation has not been found sufficient. For instance, metals boiled in mineral oil at a high temperature exhibit no potential difference on contact. Further, it has been shown that the order of the metals in the contact series when air is the surrounding medium is also the order of their tendency to combine with oxygen. It is therefore considered probable that when two metals are brought into contact, their electrical potentials are equalised by conduction, but that they are then at different potentials from the films of air which are in contact with them.

VOLTAIC CELL. A device for the direct transformation of chemical into electrical energy. In its simplest form it consists of two plates of different conducting materials, such as zinc and copper, set up in a jar containing an electrolyte, e.g. dilute sulphuric acid. If the plates be joined outside



Voltaic Cell

the cell by a conducting wire, an electric current flows round the circuit, its direction being from zinc to copper within the liquid.

During the passage of the current, zinc is dissolved, and hydrogen appears at the copper plate, the chemical action being represented by the equation $Zn + H_2SO_4 = ZnSO_4 + H_2$. The hydrogen remains on the copper, and reduces the electromotive fo of the cell—an effect known *polarisation*, which makes this sim cell of little practical use.

The most effective method of g ting rid of polarisation is to arran so that a harmless ion, instead hydrogen, is deposited on the copp plate. This is what is done in t Daniell's cell (q.v.). In the Leclanc cell a solid depolariser is used. this cell the electrolyte is a solutic of ammonium chloride, in which zinc rod is set; the copper plate the simple cell already described replaced by a carbon rod, roun which manganese peroxide is packe in a porous container.

The Cl ion from NH_4Cl attacks th zinc, and the NH_4 ion is split up int NH_3 and hydrogen. The hydroge goes to reduce the MnO_2, and, if th cell is only used intermittently, as i electric bell work, there is littl polarisation. *See* BUNSEN BATTERY ELECTRIC BATTERY; ELECTRICITY ELECTROLYSIS; ELECTROMOTIVI FORCE; IONISATION.

VOLTAIC PILE. Volta's arrange ment for producing a current of elec tricity, consisting of a pile of alternate discs of two dissimilar metals, as copper and zinc, zinc and silver, zinc and platinum, separated by pieces of flannel or pasteboard moistened with salt water or with water acidulated with sulphuric acid.

VOLTAIRE, François Marie Arouet de. French writer, born at Paris 21st Nov., 1694, died there 30th May, 1778. His father was François Arouet, a notary, and he was destined for the legal profession, but abandoned the law for letters. In 1718 a tragedy named *Œdipe* was brought out by him, and was a great success.

It is said that this play was finished, and that two cantos of his epic the *Henriade* were written in the Bastille, where he was confined from May, 1717, to April, 1718, for writing certain satirical verses on the regent.

He now became a fashionable poet and resided mainly at Paris, leading a life of gaiety and pleasure in the society of the great. It was about the beginning of this period that he adopted the name of Voltaire. In 1726 he was again imprisoned in the Bastille for sending a challenge to the Chevalier Rohan, by whom he had been grossly insulted. He was liberated within a month, and came to England on the invitation of Lord Bolingbroke. Here he resided till 1729 in friendship with the leading deists, and acquired some knowledge of English literature. His *Henriade* was completed and published by subscription in England.

After his return to France he lived chiefly at Paris till 1734. From 1734 to 1749 he resided with the Marchioness de Châtelet at Cirey, in Lorraine. She died in 1749, and Voltaire then accepted the oft-repeated invitations of Frederick the Great to come and live at his court at Potsdam. Here he was received with great honour, but a series of disagreements with the king ended in Voltaire's retirement from the Prussian court in 1753.

He then resided for a short time at Strasburg, Comar, and Lyons, removing at the end of 1754 to Geneva. For almost the whole of the remainder of his life he lived in Switzerland, or close to its borders. In 1760 or 1761 he fixed his residence with his niece, Madame Denis, at Ferney, where he received a constant succession of distinguished visitors, and maintained a correspondence which included in its range most of the crowned heads of Europe. In Feb., 1778, he went to Paris, where he was received with enthusiasm by all classes. But the excitement of the occasion hastened his death.

His works embrace almost every branch of literature: poetry, the drama, romance, history, philosophy, and even science. Hatred of fanaticism and superstition was his chief characteristic, and nearly all his works are strongly animated by a spirit of hostility to the priests and the religion they represented. He upheld theism, however, with as much zeal as he denounced Christianity and priestcraft.

Voltaire's literary fame chiefly rests on his philosophical novels: *Zadig*, *Candide*, *L'Ingénu*, etc.; his histories: *Siècle de Louis XIV.*, *Histoire de Charles XII.*; his correspondence; and more than all, perhaps, on his poetical epistles, satires, and occasional light poems, which all exhibit wit, gaiety, vivacity, and grace. Several of his tragedies, such as *Zaïre*, *Alzire*, *Merope*, *Mahomet*, had great success in their day, but are not assigned a high place in French literature.

His comedies, the best of which is *L'Enfant Prodigue*, were less successful. His *Henriade*, an epic poem, had great success, and exercised a powerful influence when it first appeared.—BIBLIOGRAPHY: Lord Morley, *Voltaire*; J. Parton, *Voltaire*; Sir E. B. Hamley, *Voltaire* (Foreign Classics for English Readers Series).

VOLTERRA (ancient **Volaterræ**). A town of Italy, in the province of Pisa; connected with the Cecina-Pisa Railway by branch line to Cecina (19 miles). It was anciently one of the twelve principal cities of Etruria, and possesses a museum rich in Etruscan antiquities. Pop. 16,784.

VOLTMETER. *See* ELECTRICAL MEASURING INSTRUMENTS; AMMETER.

VOLTUR'NO. A river of Italy, rising in the province of Campobasso, flows south-east to its junction with the Calore, and then west past Capua into the Mediterranean, 20 miles south-east of Gaeta. Length, 90 miles.

VOLUNTEERS. Originally certain bodies or companies of men enlisted in the eighteenth century to serve with the Militia (q.v.). They were so called because they enlisted of their own free will, and so saved a particular locality from enforcement of the Militia Ballot Act; but they had no separate existence, and were merged in the Militia. In 1794 an Act was passed recognising various Volunteer companies which had been raised in expectation of a French invasion, and making provision for their pay and discipline if and when called out.

Early in the next century a very large number of Volunteer corps, both yeomanry (q.v.), infantry, and artillery, were raised, and some 400,000 men are said to have been enrolled; but in many cases these corps were little better than rifle clubs, and Fortescue estimates that not more than 60,000 could have taken the field. "Fencibles," as some corps were named, are generally classed as "Volunteers," but in vol. iv. of his *History of the British Army* Fortescue says distinctly that these were "regular troops enlisted for service at home and for the duration of the war only."

After 1814 the Volunteer movement languished, and Volunteers almost ceased to exist till a new scare of war with France in 1859 again brought them into being, and for the next fifty or sixty years various Acts of Parliament dealing with Volunteer organisation were passed.

When the Territorial grouping of the Regular army became a *fait accompli* in the 'seventies of last century, all Volunteer units were affiliated with the county regiments; then, in 1907-8, with the passing of the Territorial and Reserve Force Act of 1907, all existing Volunteers became absorbed into the Territorial Force (now Territorial Army). *See* TERRITORIALS.

VOLVOX. A remarkable genus of freshwater Green Algæ, group Volvocales. The plant consists of a small sphere of translucent jelly, embedded

in which are a number of minute green cells (over 20,000 in the largest species, *V. globator*). Each cell has all the features of an individual of Chlamydomonas (q.v.); by the combined action of the numerous pairs of flagella the whole structure travels through the water with a characteristic rolling motion. A living Volvox is one of the most attractive of microscopic objects.

VOMITING OF BLOOD. This may be due to internal injury, to poisoning by some corrosive, to varicose veins of the lower part of the gullet, or to disease of the stomach, such as cancer or ulcer.

Treatment. Keep the patient lying on his side, give no food or alcohol, and no ice to suck. Place an ice-bag on the pit of the stomach.

Remember that blood may have been swallowed, as in some cases of bleeding from the lung, and after an operation such as the removal of tonsils.

VORARLBERG. The westernmost province of Austria, comprising three districts as follows:

Districts	Area, sq. Miles
Bludenz	500·5
Bregenz	347·5
Feldkirch	156·6
Area	**1004·6**

In 1923 the population was 139,999 (mainly German-speaking Roman Catholics). Bregenz (pop. 7750) is the capital, but Dornbirn (pop. 13,800) is the commercial capital. Other towns are Bludenz (6000), on the Ill, and Feldkirch (5000). All these places are engaged in the textile industry, and Bregenz, Bludenz, and Feldkirch are on the railway Lindau-Innsbruck-Salzburg (*see* ARLBERG; TIROL). Other lines are the Feldkirch-Buchs and Lautracht-St. Margarethen railways. Some 13 sq. miles on the Lake of Constance belong to Vorarlberg, which possesses only 121 sq. miles of land classed as unproductive, the remainder comprising 66·58 per cent pastures, 29·45 per cent wooded land, and 3·97 per cent agricultural, viticultural, and horticultural land.

A mountain land, Vorarlberg comprises in the north the Bregenzer Wald, a branch of the Algäuer Alps, traversed by the valley of the Bregenz Ach and draining to the Boden-See (Lake of Constance).

Bezau is the chief place (pop. 1100). In the south are the Rhätikon Alps and the Silvretta group, north of which are the Ill Valley, the K tertal, and Montafontal. The west versant drains to the Rhine, and eastern, by the Lech, etc., to Danube. Employments are c nected almost entirely with the l toral industry, except in towns, wh the spinning and weaving of cott etc., is the staple.

VORONEZH. A former gove ment of Russia. Area, 25,443 miles; pop. 3,687,000. It is int sected by the Don, which receives t whole of the drainage, partly throu its tributaries the Voronezh a Khoper. Large crops of grain a raised.

VORONEZH. A town of Russ on the Voronezh. It is an importa entrepôt on the railway between Mo cow and the Sea of Azov. It h manufactures of woollen and lin cloth, soap, and vitriol, tanneric and a considerable trade. Pop. (1926 120,017.

VORTEX. In the popular sense the word, a mass of fluid, especiall water or air, the particles of whic are moving in circles about a commo axis. When a rotating liquid has free surface exposed to the atmo phere, the resultant of gravity an centrifugal force must be perpen dicular to the free surface at any point. This is the cause of th hollows or dimples which may often be observed in slowly moving streams In hydrodynamical theory, the word vortex has a different sense, being used to denote any portion of fluid in which there is *molecular* rotation (*see* HYDRODYNAMICS). A smoke ring is a vortex in this theoretical sense.

VORTICELLA, or **BELL-ANIMALCULE.** A genus of stalked infusoria, having a fixed stem capable of being coiled into a spiral form, and vibratile cilia fringing the bell-shaped disc, which are constantly in rapid motion and attract particles of food. Some bells are free-swimming, and reproduction is effected by longitudinal fission; conjugation takes place by fusion of a small free-swimming individual with a large stalked one. The species are very numerous in fresh water, and are generally microscopic. Some closely related forms, e.g. Zoothamnium, are colonial.

VORTICISM. An English movement in art comparable to Cubism and Futurism on the Continent. It is related to Futurism (q.v.) in seeking to express the mechanical character of modern industrial life; but rejects its methods as being merely a development of Impressionism (q.v.). It is related to Cubism in claiming that the

sole concern of art is with form, and that the artist's business is not to reproduce the appearance of nature, but to create new realities.

These ideas apply to every form of art, since every kind of emotion experienced by an artist has an appropriate form of expression in an appropriate material, either words, solid matter, or colours and shapes on a flat surface. These forms, however, are not symbols of these emotions, but direct channels for their conveyance.

The word vorticism is derived from *vortex*, which is held to represent a generalised conception in the artist's mind of relations in the universe, through which ideas pass and take concrete shape; as in the general equation of a circle in analytical geometry, the substitution of numbers for the letters converts the general into a particular circle.

Leading figures in the early days of the movement were Ezra Pound, poet and writer; H. Gaudier-Brzeska (1891-1915), sculptor; Wyndham Lewis, Frederick Etchells, William Roberts, Edward Wadsworth, and Cuthbert Hamilton, painters. In 1913 they were associated in the production of two numbers of a periodical *Blast*, wherein their theories were expounded; and they exhibited at the London group, seceding later to form the X group.

Their earlier work was mainly based on three dimensional geometric forms; but individual members soon broke away from this convention, and the tendency in every case has been towards closer reproduction of natural appearance. Thus, from purely abstract patterns, Wyndham Lewis has passed to representing the structure of natural objects, chiefly of the human body. For practical purposes the movement is dead.—Cf. Ezra Pound, *Life of Gaudier-Brzeska*.

VOSGES (vōzh). A chain of mountains about 100 miles long, extending N.N.E. to S.S.W. through North-Eastern France, nearly parallel with the Rhine. The breadth varies from 20 to 45 miles, and the highest peak is Ballon-de-Guebwiller, 4685 feet. Great part of the Vosges is densely wooded, and the eastern and southern slopes are often covered with vineyards. There is also excellent pasturage. The Ill, Lauter, Moselle, Meurthe, Saar, and Saône rise in this chain.

VOSGES. An eastern department of France; area, 2303 sq. miles. It is bounded on the east by the Vosges Mountains, which send out ramifications over the greater part of its surface, whilst in the south it is traversed by the chain of the Faucilles. Grain, hemp, flax, and potatoes are extensively grown, and the department is famous for its kirsch-wasser. The principal rivers are the Meuse, Mouzon, Madon, Moselle, Saône, and Meurthe, all unnavigable within the department. The minerals are valuable. Manufactures include cotton and lace. Épinal is the capital. Pop. (1931), 377,980.

VOTYAK. A division of the Permian group of the Turanian family of peoples and languages. The Votyaks, about 420,000 in number, are Christians, and inhabit the valleys of the Vyatka and the Kama. There has been considerable intermarriage with Turanians of Tatar stock.

VOTYAK AREA. *See* RUSSIA (table).

VOYVODINA. The historical designation of that part of Yugoslavia north of Belgrade. It comprises the districts of Banat, Batchka, Baranya, and part of Srem (Syrmia); area, 7607 sq. miles; pop. 1,380,413.

VRCHATZ. A town of Yugoslavia. It has silk-mills and a large trade in silk and wine, the latter largely curtailed by the ravages of phylloxera. Pop. (1931), 29,423.

VULCAN (Lat. *Vulcānus*). In Roman mythology, the god who presided over fire and the working of metals. He was completely identified with the Greek Hephæstus (q.v.).

VULCANITE, or **EBONITE.** A hard variety of india-rubber obtained by heating raw rubber, mixed with from 20 to 50 per cent of sulphur, for several hours at a temperature of about 140° C. Filling materials are sometimes added to cheaper varieties. The mixed mass is moulded to the required shape and placed in the vulcanising chamber, which is heated by means of steam under pressure.

Vulcanite is a hard, black, horn-like solid; it can be turned in a lathe and made to take a high polish. It is largely used in electrical work as an insulating medium, and, owing to its resistance to most chemical reagents, it is employed for making pipes, taps, etc., for use in many chemical industries.

VULGATE. The *Vulgate* is the Latin version of the Bible which was made by the great scholar Jerome towards the end of the fourth century, at the request of Damasus. Before long it became *the* Bible of the Western Church, and throughout the Middle Ages it was the standard and final court of appeal for dogma. The comparative lack of Greek scholarship left it with a free field, and its

predecessors soon ceased to rival it, or even to exist.

The Council of Trent, in the sixteenth century, formally pronounced Jerome's version to be the "vetus et vulgata editio" of the sacred Scriptures. This ecclesiastical imprimatur only recognised the position gained long before by the version, which for over a thousand years had represented the Bible to Western Europe. The term *Vulgate* is derived from the participle *vulgata* (meaning "current" or "commonly received").

Latin being the language of the ecclesiastical and political as well as of the literary world, the *Vulgate* naturally prevailed, and even such vernacular versions as had occasionally been tolerated were made, not from the original Hebrew or Greek, but from the *Vulgate*—or, as it was then called, "our edition" or "the New Version."

It was the real Bible of the Middle Ages. That it did not represent the original accurately, that it was based on a Greek text which was not altogether primitive, and that its own text was not pure—all this was unsuspected till scholarship reawakened at the Reformation.

The Council of Trent's declaration that the *Vulgate* was the only, undisputed Word of God, containing the authoritative text of the Scriptures, was a novelty, "in violent opposition to the best usages of the Mediæval Church. It cast aside as worse than useless the whole scholarship of the Renaissance both within and outside of the Mediæval Church" (Lindsay, *History of the Reformation*, vol. ii., p. 573). But this decision was accompanied by another, which was equally momentous, for the Council of Trent also committed the Roman Church to the acceptance of all the books in the *Vulgate* version as canonical.

This had one novel feature. The canon represented in the *Vulgate* of the New Testament is indeed the ordinary canon. There has never been, at any rate since the fifth century, much uncertainty about what books ought to be regarded as canonical in the New Testament. There have been some differences of opinion as to their order, but that is all. It was otherwise with the Old Testament canon.

Jerome had translated and included in his version not only the ordinary books which are to-day regarded as canonical, but "apocryphal" (it is Jerome's own term) books, such as the Wisdom of Solomon, Ecclesiasticus, Judith, and Tobit, the first two books of the Maccabees, and (marking these specially) the Story of Susanna, the Song of the Three Children, and the Story of Bel and the Drag These last-named books are Jew additions to the books of Daniel.

The *Vulgate* canon, therefore, Genesis, Exodus, Leviticus, Numb Deuteronomy, Joshua, Judges, Ru Samuel, Kings, Chronicles, Ez Nehemiah, Tobit, Judith, Esther (w apocryphal additions), Job, Psalı Proverbs, Ecclesiastes, Canticles, Wisdom of Solomon, Ecclesiastic Isaiah, Jeremiah, Baruch, Lam tations, Ezekiel, Daniel (with ap ryphal additions), the minor p phets, first and second Maccabe and (relegated later to an append first and second Esdras, and t Prayer of Manasseh.

During the Middle Ages, in spite repeated efforts to preserve the *V gate* text in a pure condition, it becar seriously corrupted; although t Council of Trent planned an offic text, nothing was done by the autho ties until, under the auspices of Po Sixtus V. (1585-90), the Sixtine editi was issued. Even this was unsati factory. Under his successor, Po Clement VIII., the more successf Clementine edition was published 1592. At present Roman scholars a at work upon a pure text of th standard authority.

BIBLIOGRAPHY: The standard wor on the subject is S. Berger's *Histoi de la Vulgate pendant les premie siècles du moyen âge* (Paris, 1893 There are discussions of the Old Testa ment canon in W. R. Smith's *Ol Testament in the Jewish Church*; c the New Testament canon and Je rome's translation of the New Testa ment, in B. F. Westcott's *Genera Survey of the History of the Canon o the New Testament*, and in A. Souter' *Text and Canon of the New Testamen* (1913).

VULTURE. The common name fo the raptorial birds belonging to the family Vulturidæ, characterised by having the head and part of the neck destitute of feathers, and a rather elongated beak, of which the upper mandible is curved at the end. The strength of their talons does not correspond with their size, and they make more use of their beak than of their claws.

In general they are of a cowardly nature, living chiefly on dead carcasses and offal. Their geographical distribution is confined chiefly to warm countries, where they act as scavengers. There are two families, one (Cathartidæ) including New World forms, and the other (Vulturidæ) those native to the Old World. The chief American types are the condor (*Sarcorhamphus gryphus*), king vulture (*Gyparchus papa*), Californian vulture

udogryphus californianus), turkey-ards (species of Rhinogryphus), the American black vulture *harista atratus*). Among Old ld forms may be mentioned: mon black vulture (*Vultur mona-*), griffon vulture (*Gyps fulvus*), the Egyptian vulture (*Neophron nopterus*). *See* separate entries.

Egyptian Vulture (*Neophron percnopterus*)

VYATKA, or **VIATKA.** An eastern vernment of Russia. Physically it a plateau covered with low hills 00 feet above Nolinsk), and drain- to the Volga by the Kama and atka. There are many lakes and at marshes. The climate is severe, and at Slobodka, on the Lyetka, the mean annual temperature is 34·5° F. (January mean, 5·3°; July mean, 65·3°). Vyatka is the capital; other towns are Orlov and Elabuga.

Iron provides the chief industry, and is mined and manufactured within the government (ironworks at Kamsko-Votkinsk and Izhevsk); but the population (80 per cent Russian and the rest mainly Tsheremisses and Votyaks, q.v.) is overwhelmingly agrarian, and Vyatka was one of the granaries of Imperial Russia. It is also noted for ponies, and there is a great yearly pelt and fur market at Kotelnich. Leather, chemicals, and brandy are subsidiary products. Area, 59,329 sq. miles; pop. 4,062,000.

VYATKA. A town of Russia, capital of the government of Vyatka, on the Vyatka; the junction for Leningrad on the Perm-Kotlas Railway. It has a large river trade with Kazan (cereals, leather, soap, etc.). The mean annual temperature is 35° F. (January mean, 8·2°; July mean, 67·0°). Pop. 60,100.

VYRNWY. A river of Wales, in northern Montgomeryshire, a tributary of the Severn. Lake Vyrnwy, the chief reservoir of the Liverpool waterworks, was formed by damming the upper part of the river. It has an area of close on 2 sq. miles. The work was carried out between 1890 and 1910.

W

W. The twenty-third letter of the English alphabet, representing a consonantal sound formed by opening the mouth with a contraction of the lips, such as is performed in the rapid passage from the vowel sound *u* (*oo*) to that of *i* (*ee*). The character is formed, as its name indicates, by doubling the *u* or *v*. At the end of words or syllables it is either silent, as in *low*, or it modifies the preceding vowel, as in *new*, *how*, having then the power of a vowel.

WABASH (wą'bash). A river of the United States, which rises in Mercer county, Ohio, traverses Indiana, forms the boundary between Indiana and Illinois, and falls into the Ohio after a course of 550 miles. It is navigable for steamboats to La Fayette, and connects Lake Erie with the Ohio by the Wabash and Erie Canal.

WABASH. A city of Indiana, United States, the county seat of Wabash county, on the Wabash River; served by the Wabash and other railways. It is an agricultural centre, and has manufactures of agricultural implements, etc. Settled in 1834, it became a city in 1866. Pop. 8840.

WÄCHTERSBACH. A town in the Prussian province of Hesse-Nassau, a junction on the Bebra-Frankfurt-am-Main railway, for Birstein (pop. 1200), and Bad Orb (a spa with three mineral springs; pop. 5000). Dyeing, brewing, etc., are carried on. Pop. 2000.

WACO. A city of Texas, United States, the county seat of M'Lennan county, on the Brazos River; served by the Missouri, Kansas & Texas, and other railways. It is the seat of two universities, and is an agricultural centre. Settled in 1849, Waco became a city in 1909. Pop. (1930), 52,848.

WAD, or **BOG MANGANESE.** A black or dark-brown earthy mineral composed of hydrous manganese oxide, allied to psilomelane. It is mainly formed in swamps and bogs, and its formation is probably assisted, like that of bog iron ore, by bacterial action.

WADA'I, or **WADAY'.** A part of French Equatorial Africa, formerly a native state of the Sudan, with a population estimated at about 1,000,000, and an area of 170,000 sq. miles. It consists principally of a plateau, and comprises much desert, but produces maize, millet, cotton, etc., in parts. Wadai was recognised by Britain and Germany as under French influence, and in 1903 the people accepted the protectorate of France. The prevailing religion is Mahommedanism. Capital, Abeshr.

WADELAI. A town of Uganda, on the Bahr el Jebel (Nile), below Lake Rubi. The district became British in 1894, and Wadelai was the chief station of Emin Pasha (Dr. Edward Schnitzer), Governor of the province, who, after the Mahdist rising, was cut off from civilisation, and was relieved by H. M. Stanley. It is a hot place with a mean annual temperature of 79·3° F. Rain falls all the year round, but the driest period is from December to February. July and August are the coolest months, March the hottest, and October the month of greatest rainfall.

WÄDENSWIL. A town of Switzerland, in the canton of Zürich, on Lake Zürich; the junction for Einsiedeln, on the Glarus-Zürich railway. Silk-weaving is the chief industry. Pop. 10,000.

WADHAM COLLEGE (Oxford). An institution endowed with estates purchased by Nicholas Wadham, of Meryfield, Somersetshire, and opened in 1613. Among distinguished men of Wadham College have been Admiral Blake, Sir Christopher Wren, and Frederic Harrison.

WAGGA-WAGGA. A town of New South Wales, Australia, on the Murumbidgee, 120 miles west of Canberra. Pop. (1931), 9110.

WAGNER, Wilhelm Richard. Born at Leipzig in 1813, died at Venice in 1883. He was reared in a theatrical and musical atmosphere, which no doubt helped him to overcome what in a lesser man would have been the disadvantages of a very desultory musical education. He studied for a short time under Gottlieb Müller, and later, in 1831, with Theodor Weinlig. In 1833 he was appointed chorus-master at the Würzburg theatre, and

in the autumn of the following year music-director at Magdeburg.

Here he first met Minna Planer, a singer at the theatre, whom he married in 1836. The marriage was not happy. In connection with the acceptance and production of his various operas, Wagner had more than the usual worries. He wrote a great deal in a vain endeavour to make his objects and ambitions plain to the general public. From 1839 to 1842 he lived in Paris by hack-work, and was often in great financial straits.

In 1842 he went to Dresden, where *Rienzi*, produced in that year, was received with enthusiasm. *The Flying Dutchman*, first performed at Dresden in 1843, disappointed the public; *Tannhäuser*, performed in 1845, puzzled them still more. Though Wagner had little to do with the political upheaval of 1849, he was in danger of arrest, and, after the riots in Dresden, had to retire into exile till 1861. During this period he was occupied with *The Ring* and *Tristan and Isolde*.

In 1863 he published the complete poem of the *Ring des Nibelungen* as a literary product, intimating that he hardly expected to find leisure to complete the music and had no hope of seeing it performed. In the following year King Ludwig II. of Bavaria came to the throne, and became an enthusiastic patron of Wagner. The *Ring* was ultimately completed, though there was no performance of the entire work till Aug., 1876, when it was given three times at Bayreuth in the new theatre specially built for the purpose according to Wagner's own design. *Parsifal* was completed in Jan., 1882. Wagner had separated from his wife in 1861, and in 1870 he married Cosima von Bülow, daughter of Liszt.

Wagner's aim in his operas was to unite the separate arts of music, poetry, painting, etc., into a complete whole, and though in a measure he was successful, the supreme quality of his works is always the musical. His idea of "leading motives," i.e. melodic or harmonic phrases specially identified with a particular character or object of the drama, made a tentative first appearance in *Lohengrin*, and was completely adopted in his subsequent works. His greatest operas are *Tristan and Isolde*, *The Mastersingers*, and *The Valkyrie*. He has been justly called "the grandest and most original dramatic composer of all time."—BIBLIOGRAPHY: W. E. Ashton, *Life of Richard Wagner*; H. T. Finck, *Wagner and his Works*.

WAGRAM. A village of Austria, on the Russbach; served by the Breclava (Lundenburg)-Vienna Railway. It is famous for the great battle in 1809 between the French under Napoleon and the Austrians under the Archduke Charles, each about 150,000 strong. The battle was well contested, but the result gave Napoleon a decisive victory, which was followed up by an armistice and the Treaty of Vienna or Schönbrunn (14th Oct.).

WAGTAIL. A name of small perching birds of the family Motacillidæ, and so termed from their habit of jerking their long tails when running or perching. They inhabit meadowlands and pastures, frequent waterpools and streams, are agile runners, and have a rapid flight. Their food consists of insects. Their nests, built on the ground, contain from four to six eggs. These birds belong to both Old and New Worlds, and migrate southwards in winter; but the pied wagtail (*Motacilla lugubris*) is a permanent resident in Britain.

It is almost wholly black on the upper parts; the under parts are greyish-white. Other representative varieties, distributed principally over the European continent and the East, are the white wagtail (*M. alba*), the grey wagtail (*M. melanopes*), and the yellow wagtails (*M. flava* and *M. rayii*).

WAHA'BITES, or **WAHABIS.** A Mahommedan sect, founded in Arabia about 1760 by Abd-el-Wahâb, an Oriental scholar of high attainments (1704-92). He deemed it his mission to restore Islam to strict harmony with the teachings of the *Koran* and the *Sunna*. Thousands flocked to the Wahabite standard, and enabled the reformer to secure the whole of his native province, Nejd, and to carry his victorious arms into Yemen.

Under his successors the greater part of Arabia fell under the Wahabite power. Mecca and Hejaz were captured in 1803, and the loss of the sacred city roused the Turks to action. Several expeditions were sent from Egypt, and in 1818 Ibrahim Pasha was at last successful in dispersing the Wahabite forces, in capturing their capital, Derayeh, and their leaders, who were executed at Constantinople. They, however, gradually regained their influence, especially in their native homes of Nejd.

From Arabia the Wahabite movement spread into Africa, where it influenced the founder of the Senussi brotherhood, and into India. In its modern form Wahabism is the foundation of the power of the emir of Nejd and Hasa (q.v.). It is most important to see article HEJAZ.

WAIKA'TO. One of the principal rivers of New Zealand, in North Island; length, 175 miles.

WAIVER, in English law, is the renunciation or abandonment of a right. The renunciation or abandonment may be express, e.g. by deed, or implied, e.g. by the party possessing the right in full cognisance of it either neglecting duly to enforce it or performing acts which, being inconsistent with its subsistence, are indicative of an intention to abandon it.

The doctrine of waiver is important in judicial proceedings. If a party to a cause desires to have any judicial proceeding set aside on the ground of irregularity, he must make application to the court to that effect within a reasonable time after the irregularity has come to his notice and before he has taken any further step in the proceedings with the knowledge of it; otherwise he is held to have waived his right.

WAKAMATSU. A town of Japan, in the Island of Honshiu; served by the Tokyo-Sendai Railway. It has a State steelworks. Pop. 57,326.

WAKATIP'U. A lake in the South Island of New Zealand; area, 114 sq. miles. Queenstown and Glenorchy, on the borders of the lake, are favourite tourist resorts.

WAKAYAMA. A town of Japan, a prefecture capital, in the Island of Honshu; served by rail to Osaka. Pop. 95,622.

WAKE. A term corresponding originally to *vigil*, and applied to a festival held on the anniversary of the day on which the parish church was consecrated and dedicated to a saint. A *lyke* or *lich wake* (A.-S. *lic*, a corpse) is the watching of a dead body by night by the relatives and friends of the deceased.

WAKEFIELD. A borough and episcopal city of England, in the West Riding of Yorkshire, on the Calder. The industrial establishments include woollen-mills. The cathedral church of All Saints dates from the fifteenth century, and the grammar-school from 1591. Pop. (1931), 59,115.

WAKE ISLAND. An uninhabited island belonging to the U.S.A., in the South Pacific, north of the Marshall Islands. Like Midway Island, northwest of Hawaii, it is a cable-landing station.

WALCHEREN (vål'ke-rên). An island of the Netherlands, in the province of Zeeland, at the mouth of the Scheldt. It is level, below high-water mark, very fertile, populous, and prosperous. It contains the towns of Flushing (Vlissingen), Middelburg (capital), and Veere. On 30th July 1809, the British expedition under Lord Chatham (elder brother of Pitt) landed near Veere, and took it. Middelburg, and Flushing, but had to retire in the following December, after losing 7000 men by marsh fever.

WALDECK. Till 1929 a republic of the German Reich, hilly, drained to the Weser by the Eder (with the Werbe and Aar) and the Diemel (with the Twiste); served by the Korbach-Arolsen-Warburg, the Wabern-Wildungen, and the Korbach-Frankenberg railways. Arolsen is the capital: the baths of Wildungen (Niederwildungen; pop. 4000) are world-famous, and the waters are exported. About 55 per cent of the area is cultivated meadow land, and 38 per cent is wooded. There is a cattle-raising industry. The mean annual temperature is from 45° to 49° F. In 1929 Waldeck was absorbed in Prussia. Area, 433 sq. miles; pop. (1925), 55,816.

Pyrmont, an enclave of Brunswick, Hanover, Lippe, and the detached Prussian appanage Lügde, was united by a personal bond with Waldeck, through the reigning house. Ruled by its own counts until 1494, in 1557 it passed to Lippe and in 1583 to the Counts of Gleichen, coming under Waldeck in 1625, and remaining a Waldeck principality until 1918. On 1st April, 1922, it was absorbed in the province of Hanover. Pyrmont (pop. 2600), on the Emmer, is the chief town, and is one of the best-known health-resorts in Europe. There are six mineral springs and a mud bath, visited by about 30,000 persons yearly. Area 25·5 sq. miles; pop. 10,000 (90 per cent Lutheran).

WALDENBURG. (1) A town of Saxony, on the Zwickauer Mulde; served by the Glauchau-Penig (pop. 7000) railway. Woollens, cottons, etc., are made. Pop. 4000. (2) A town of Prussian Silesia, the centre of the Waldenburger Gebirge coalfield; an important junction on the Kohlfurt-Glatz railway for the Dittersbach-Salzbrunn line. There is a porcelain factory, and machinery, matches, and linen are made. Pop. 44,111. Important mineral springs exist at Salzbrunn (eight springs; the chief spa in Silesia; pop. 12,000), and Charlottenbrunn (on the Kohlfurt-Glatz line; pop. 2000). (3) A town and spa of Württemberg; a junction on the Heilbronn-Halle railway from Künzelsav (pop. 3200). Pop. 2000.

WALDEN'SES, or VAUDOIS. A Christian sect owing its origin to Peter Waldo (Waldus), a citizen of Lyons, who collected numerous followers in the twelfth century. Recent

historians are of opinion that the Waldensian movement is really a fusion of four distinct reform movements which originated from the tenth to the twelfth century. The design of the founder of the Waldensian movement was to reform the clergy, and to preach the word of God freely to everyone in his native language, but subsequent followers went far beyond the original plan.

They made the Bible alone the rule of their faith, renounced entirely the doctrines, usages, and traditions of the Roman Church, and formed a separate religious society. Excommunicated as heretics, the Waldenses for centuries suffered merciless persecutions, which only ceased in the eighteenth century.

Their stronghold is in the mountain tract of the Cottian Alps, and since 1848 they enjoy equal religious and political rights with the Roman Catholics of Italy. Separate congregations were founded in various parts of Europe, but amalgamated with other reformed sects.

The Waldensian rites are limited to baptism and the Lord's Supper, respecting which they adopt the doctrine of Calvin. Their congregations are superintended by consistories composed of elders and deacons, under the presidency of a moderator.—Cf. J. Gibson, *The Waldenses*.

WALES. A principality in the south-west of the Island of Great Britain, which since Edward I. gives the title of Prince of Wales to the heir-apparent of the British Crown; area, 7466 sq. miles; pop. (1931), 2,158,193. It is divided into twelve counties, for the names and areas of which see the article ENGLAND.

Physical. As a whole it is very mountainous, particularly in the north, where Snowdon, the culminating point of South Britain, rises to the height of 3560 feet; and it is intersected by beautiful valleys, traversed by numerous streams, including among others the large river Severn.

Production and Industry. It is rich in minerals, particularly coal, iron, copper, and even gold, and to these Wales owes its chief wealth. The coal trade is most extensive, and Cardiff is one of the largest coal ports in the world. Swansea may be considered one of the greatest oil ports. Iron, steel, and copper works are on a large scale.

Besides the mineral industries, there are considerable woollen manufactures, especially of flannel, coarse cloth, and hosiery. (*See* ENGLAND and BRITAIN.

People. The inhabitants are almost purely Celtic in race, being the descendants of the early Britons, who were able to maintain themselves here when the rest of the country was overrun by the Germanic invaders. A majority of the inhabitants are Nonconformists or Dissenters, such as Congregationalists, Calvinistic methodists, and Baptists.

History. Previous to the Roman occupation Wales appears to have been chiefly inhabited by three British tribes, called the Silures, Dimetæ, and Ordovices. During the later period of the Roman occupation the subject part of the island was divided into four provinces, of which one, including the country from the Dee to the Severn, was called *Britannia Secunda*. It was after the invasion of the Saxons that the country acquired a distinctive national character as the refuge of the vanquished Britons who were gradually driven to the west.

From this period until the final conquest of the country by Edward I. there is little but a succession of petty wars between the rival chiefs or kings into which both countries during a great part of the Saxon period were divided, or the more systematic efforts of the larger monarchy to absorb the smaller.

Among the greatest of the Welsh heroes of the early period was Cadwallon. After being defeated by Edwin of Deira, or Northumbria, and compelled to flee to Ireland, he returned and defeated the Saxons in numerous battles, but was at last defeated and slain by Oswald of Northumbria in 635. The last of the Welsh princes, Llewellyn, who revolted against Edward I., was defeated and slain by the Earl of Mortimer in 1284, and since that time the principality has been incorporated with England.

Language. The native name of the Welsh language is Cymraeg, the speech of the Cymri (q.v.). The names Wales and Welsh are of Anglo-Saxon origin, from *wealas*, strangers, foreigners (plural of *wealh*). The Welsh language is, with the other Celtic languages, included in the Indo-European group. The alphabet contains thirteen simple and seven double consonants, and seven vowels, with numerous diphthongs and triphthongs. It is still spoken exclusively by more than a quarter of a million of the inhabitants of Wales. The necessities of commerce are, however, gradually doing for the Welsh language what they have done for the Irish and Gaelic, and English is becoming more and more the language of everyday life in Wales.

Literature. The earliest remains of Welsh literature are supposed to belong to the ninth century. There

are a number of poetic pieces attributed to Taliesin, Aneurin, Merlin, and Llywarch Hen, bards supposed to have lived in the fifth century; but great and reasonable doubts have been thrown on the authenticity of these early productions, which, in their present form at least, are not believed to be earlier than the eleventh century.

Subsequent to this time there were numerous poems written, many in praise of warriors, others dealing with love, or descriptive of nature. Dafydd ap Gwilym (1293-1356) has been called the Ovid of Wales. Huw Morris (1622-1709) and Goronwy Owen (1722-80) are likewise distinguished as poets. The last produced the *Cywydd y Farn* (*Day of Judgment*), regarded as the finest poem in the language.

There are a number of prose tales or romances, the chief of which are contained in a collection known as the *Mabinogion*. The first Welsh book ever printed appeared in 1546. Modern works in Welsh are mostly confined to theology, history, and biography. *See* CELTIC CIVILISATIONS; CELTIC LITERATURE; CELTIC MYTHOLOGY; CELTS; articles on various counties and towns; maps of England and Wales under ENGLAND.

WALKA, or **WALK.** A town of Estonia, on the Latvian frontier and on the River Peddell; an important junction on the Riga-Leningrad Railway for Pärnu (Pernau), Pskov, Aluksne (Marienburg), and Tallinn (Reval). There are flax markets, and grain is traded. Pop. 10,000.

WALKER CUP. International amateur golfing trophy competed for annually by representative teams from Great Britain and America. America has held the trophy for a number of years.

WALKER, George. Irish clergyman, born of English parents, in County Tyrone, in the early part of the seventeenth century, and killed at the battle of the Boyne in 1690. He studied theology at Glasgow University, and after taking orders obtained the living of the parish of Donoughmore. The arrival of James II. in Ulster (1689) caused Walker to seek refuge in Londonderry; and in the memorable siege of that city he took the most prominent part both in word and deed. After the siege Walker went to London, was presented with the bishopric of Derry and £5000, and Parliament voted him its thanks. Instead of taking quiet possession of his bishopric, he accompanied William III. in his Irish campaign, and fell a victim to his courage.

WALLACE, Alfred Russel. B scientist, born at Usk, Monm shire, in 1823, died in 1913. Edu at Hertford grammar-school, he s many years in travelling, espe in South America and the A Islands, and the valuable mat collected in these scientific exp tions he embodied in *Travels o Amazon and Rio Negro*, *The M Archipelago*, *Tropical Nature*, *Geographical Distribution of Anim* etc.

His observation of animal life e led him on the track of natural s tion, and before Darwin gave famous work to the world he written an essay anticipating *Origin of Species*. His share in es lishing the theory was acknowle by Darwin. But while Darwin, in later editions of *The Origin of Spe* somewhat modified his original c clusions, Wallace, in his mature w *Darwinism, an Exposition of Theory of Natural Selection,* a *some of its Applications* (1889), sisted upon the controlling effect the survival of the fittest in struggle for existence. He, howe differed from Darwin on the subj of the intellectual, moral, and spirit nature of man.

He contended that the higher fac ties have been developed not un the law of natural selection, but un a higher law, which has come in i perceptibly; and that the Darwini theory, instead of opposing, "ler a decided support to a belief in t spiritual nature of man." He claim to be at once a true Darwinian a an anti-materialist. Among his lat publications are: *Man's Place in t Universe*, *Social Environment a Moral Progress*, and *The Revolt Democracy*.—Cf. J. Marchant, *Alfr Russel Wallace: Letters and Remin cences*.

WALLACE, Edgar. English jou nalist. Born in London in 1875, ar brought up by a Billingsgate fis porter, he developed literary tast while a soldier in South Africa, an then became a war correspondent and later dramatic and racing jou nalist in London. He had an ur rivalled acquaintance with the crim nal classes, and wrote 150 novels an 14 plays. He died 10th Feb., 193 in Hollywood, California.

WALLACE, Sir William, the her of Scottish independence, is said t have been the younger son of Si Malcolm Wallace of Elderslie an Auchinbothie, by Margaret, daughte of Sir Reynold Crawford, sheriff o Ayr. He was probably born abou 1270. For the most detailed par ticulars we possess about this famou

Scottish character we are almost entirely dependent on Blind Harry; but the narratives cannot bear the scrutiny of the critical historian. Contemporary Scottish records do not exist, while the English chroniclers of the period were but imperfectly informed and prejudiced. Wallace is described as a man of herculean proportions and strength, and it is certain that he possessed in a high degree the qualifications of a commander.

He is represented as having been for some years engaged in a partisan war against the English before what is represented by Blind Harry as the turning-point in his career took place, the slaughter of Haselrig in revenge for the murder of his wife, and in pursuance of his vow of eternal vengeance against the invaders of his country. Henceforth he continued in open resistance to the English, and, having collected a considerable force, was besieging the castle of Dundee when he heard that Surrey and Cressingham were advancing upon Stirling with a large army. He met them in the vicinity of that town, and, thanks to his ingenious military tactics, gained a complete victory (1297).

After this Wallace appears with the title of Guardian of the Kingdom, which was temporarily cleared of the English, and is found conducting a series of organised raids into England. In 1298 Edward I. entered Scotland with an army estimated at nearly 90,000 men. Wallace retired before him, wasting the country, but was at length overtaken at Falkirk, and compelled to fight. After a gallant resistance his army was routed. He succeeded in escaping, and little is known of his movements henceforth.

He was excluded from the peace granted by Edward to the Scottish Council of Regency in 1304, and every effort was made to secure his apprehension. It was effected through Sir John de Menteith, governor of Dumbarton Castle. Wallace was conveyed to London, and after a mock trial found guilty of treason and rebellion, and executed on 23rd Aug., 1305.

A memorial to Wallace has been placed on the summit of Abbey Craig, near Stirling, in the form of a Scottish baronial tower, surmounted by an architectural crown, and having a height of 220 feet.—BIBLIOGRAPHY: James Moir, *Sir William Wallace*; A. F. Murison, *Sir William Wallace*; P. F. Tytler, *History of Scotland*.

WALLACE, William Vincent. Musical composer, born of Scottish parents at Waterford 1813, died in France 1865. In 1845 he went to London, and devoted himself to composition. His first opera, *Maritana*, was produced at Drury Lane, 1845, and secured him at once a reputation. *Lurline* and *The Amber Witch* are his other chief operatic compositions.

WALLACE COLLECTION. A collection of pictures, sculptures, arms and armour, furniture, china, etc., belonging to the British Government, and now displayed in Hertford House, Manchester Square, London, W. It was bequeathed to the nation in 1897 by Lady Wallace, widow of Sir Richard Wallace (1818-90). The collection was first open to the public in 1900.

WALLACHIA. *See* RUMANIA.

WALLAROO. A seaport-town in South Australia, on the Spencer Gulf, 91 miles north of Adelaide. The Wallaroo and other copper-mines are in the neighbourhood, and smelting-works are carried on at Wallaroo Bay. Pop. 3097.

WALLASEY. An urban district and municipal borough of Cheshire, England, on Wirral Peninsula, at the mouth of the Mersey. The grammar-school was originally founded in 1595, and the parish church of St. Hilary is a tenth-century foundation (rebuilt about 1790; tower dates from 1530). Liscard, Seacombe, Poulton, etc., are included within the municipal borough. Pop. (1931), 97,465.

WALLENSTEIN (vál'en-stīn), **Albrecht Wenzel Eusebius von.** Duke of Friedland, Bohemian soldier and statesman, born at Hermanic, in Bohemia, 1583, assassinated at Eger 1634. He served first in Hungary, and in 1618, at the outbreak of the Thirty Years' War, he joined the imperial forces against his native country. His estates, valued at 30 million florins, he was allowed to form into the territory of Friedland, and in 1624 he was created Duke of Friedland.

He raised a large army to assist the emperor against the Lower Saxon League; he defeated Count Mansfeld at Dessau (April, 1626), and compelled Bethlen Gabor to conclude a truce; he conquered Silesia, and bought from the emperor, partly with military services, partly with plunder, the Duchy of Sagan, and other extensive estates. In Sept., 1630, owing to the jealousy of the nobles and the licence of his followers, he was deprived of his command, and retired to his Duchy of Friedland until the emperor was compelled to seek his aid against Gustavus Adolphus.

After some partial successes Wallenstein encountered the King of Sweden at Lützen (16th Nov., 1632), in which battle Wallenstein was de-

feated and Gustavus killed. Wallenstein had unsuccessfully treated on his own account with the Swedish king, and he now secretly reopened negotiations with France and the German princes, occasionally taking the field to display his military power. Wallenstein was at last removed from his command, and was preparing openly to attack the imperial forces, when he was assassinated at Eger by Colonel Butler and his fellow-officers, Gordon, Leslie, and Devereux.

WALLER, Edmund. English poet, born at Coleshill (then a detached portion of Hertfordshire, but since 1832 absorbed by Buckinghamshire) in 1606, died at Beaconsfield in 1687. He came of a good family, and was educated at Eton, and King's College, Cambridge. He was elected member of Parliament for Amersham, according to some accounts, when only sixteen years of age; he was certainly elected for Ilchester when eighteen. He was thus "nursed in Parliaments," and had a long and brilliant, though not always honourable, career in the House.

He eventually became the Nestor of the assembly, and discharged this part with much diligence. In 1631 he married Anne Banks, a London heiress, who died three years later. In about 1635 he began to address verses to Lady Dorothy Sidney, daughter of the Earl of Leicester, whom he celebrated under the name of Sacharissa (Lat. *saccharon*, sugar). It is tolerably certain this his intentions towards this lady were honourable but not matrimonial.

As a member of the Long Parliament, he opposed the raising of troops by Parliament; in 1643 he was leader in a plot (known as "Waller's Plot"), to seize London for the king. His conduct resembled that of the poet Lucan (q.v.), for he informed against his fellow-conspirators to save his own life; he differed from Lucan, however, in achieving his purpose.

He was expelled from the House of Commons, fined £10,000, and banished. He married a second time, and went to France. In 1651 Waller was pardoned by Cromwell's influence, and four years later published *A Panegyric to my Lord Protector*, which gained him the appointment of Commissioner of Trade.

After the Restoration he wrote a poem, *To the King, upon His Majesty's Happy Return*. When the king complained that the former poem was superior to the latter, the poet replied with happy promptitude, "Sir, we poets never succeed so well in writing truth as in fiction."

Waller enjoyed, during his lifetime and for some while after his death, a great reputation as a poet. This reputation mainly rested upon a volume of poems which was issued in 1645. He was a careful writer, and the merit of much of his work consists in the absence of faults rather than in any positive virtues. As a lyric poet he is chiefly remembered by one poem, *Go, lovely Rose*. As a writer of heroic couplets, he is famous for having effected a revolution in that metre. He introduced, or at any rate popularised, the self-contained couplet, thus preparing the way for Pope and Dryden.

Some of his fame was doubtless due to his social position, his charm of manner, and his ready eloquence. His poetry lacks sincerity and strength, though it has smoothness as well as those saccharine qualities which he admired in the inspirer of much of his work. Unlike most of his contemporaries, however, Waller avoided conceits and far-fetched ingenuities in his verses.

WALLFLOWER. The common name of the species of plants belonging to the genus Cheiranthus, nat. ord. Cruciferæ. They are biennial or perennial herbs or under-shrubs. Many of them exhale a delicious odour, and are great favourites in gardens. The best known is the *C. Cheiri*, or common wallflower, which, in its wild state, grows on old walls and stony places. In the cultivated plant the flowers are of more varied and brilliant colours, and attain a much larger size than in the wild plant, the flowers of which are always yellow.

WALLIS, John. English mathematician, born in 1616, died in 1703. Educated for the Church at Emmanuel College, Cambridge, he took orders in 1640, and in 1663 obtained a living in London. He was Savilian professor of geometry at Oxford and one of the earliest and most prominent members of the Royal Society, founded in 1663. His works include: *Arithmetica Infinitorum* (1655); *De Angulo Contactus et Semicirculi Tractatus* (1656); *De Cycloide* (1659); *Mechanica Sive de Motu Tractatus Geometricus* (1669-71); etc.

WALLOONS. *See* BELGIUM.

WALLSEND. A borough of Northumberland, on the Tyne. There are blast-furnaces, engineering-works, chemical-works, etc. The town is situated at the end of Hadrian's Wall, hence its name. Pop. (1931), 44,582.

WALNEY. An island and bathing resort of Lancashire, England, incorporated with Barrow-in-Furness. In the centre is Vickerstown. There is

a causeway to the mainland. Pop. 3013

WALNUT. The common name of trees and their fruit of the genus Juglans, nat. ord. Juglandaceæ. The best-known species, the common walnut tree (*J. regia*), is a native of several Eastern countries. It is a large handsome tree with strong spreading branches.

The timber of the walnut is of great value, is very durable, takes a fine polish, and is a beautiful furniture wood. It is also employed for turning and fancy articles, and especially for gun-stocks, being light and at the same time hard and fine-grained. The ripe fruit is one of the best of nuts, and forms a favourite item of dessert. They yield by expression a bland fixed oil, which, under the names of *walnut-oil* and *nut-oil*, is much used by painters, and in the countries in which it is produced is a common article of diet.

In copper-plate printing it is employed to produce a fine impression, either in black or colours. By boiling the husks when beginning to decay, and the bark of the roots, a substantial dark-brown colour is obtained which is used by dyers for woollens, and also by cabinet-makers to stain other species of wood in imitation of walnut. The fruit, in a green state before the shell hardens, is much used for pickling.

The black walnut (*J. nigra*) is found in most parts of the United States of America, and in favourable situations the trunk often attains the diameter of 6 and 7 feet. It yields a wood preferable to the European walnut, but the nuts are inferior. The butternut (*J. cinerea*) is another noteworthy variety. *See* BUTTERNUT.

WALPOLE, Horace, Earl of Orford. British author, wit, and letter-writer, the fourth son of Sir Robert Walpole, born 24th Sept., 1717, died 2nd March, 1797. He was educated at Eton, and King's College, Cambridge, on leaving which he travelled two years on the Continent in company with Gray the poet. Returning in 1741, he entered the House of Commons, and he sat for various constituencies up to 1768.

In 1747 he purchased Strawberry Hill, near London, where he erected a Gothic villa, laid out the grounds with minute ingenuity, and made it a principal business of his life to adorn and furnish it with objects of curiosity and antiquarian interest. His maintenance was provided for by some sinecure appointments, obtained through his father's influence.

To his antiquarian taste he added authorship, first in verse and afterwards more extensively in prose, and in 1757 he established a private printing-press at Strawberry Hill, at which he printed not only his own works but those of others. In 1791 he succeeded his nephew in the peerage. He never took his seat in the House of Lords, and appears to have avoided using his title.

The works of Horace Walpole are numerous; but his fame as a writer rests on his *Letters* and *Memoirs*. The former are held to be unsurpassed in the English language, and both are highly interesting and valuable as a storehouse of the more evanescent traits of contemporary history.

His romance *The Castle of Otranto* set the fashion, followed by Mrs. Radcliffe and Clara Reeve, of writing "tales of terror." Walpole's manners were affected; he was fastidiously aristocratic, sensitive to criticism, and eager for applause; but under his vanity and frivolity there existed a substratum of good sense and sound judgment.—BIBLIOGRAPHY: E. Warburton, *Memoirs of Horace Walpole*; Austin Dobson, *Horace Walpole*; Mrs. Paget Toynbee's edition of Walpole's *Letters* (16 vols.).

WALPOLE, Hugh Seymour. English novelist, son of George Walpole, Bishop of Edinburgh; born in Auckland, N.Z., 13th March, 1884, and educated at King's School, Canterbury, and Cambridge. He served with the Russian Red Cross in the Great War, and was awarded the C.B.E. His first book, *The Wooden Horse*, appeared in 1909; it has been followed by many others, the favourites probably being *Mr. Perrin and Mr. Traill*, *The Dark Forest*, *Jeremy*, *The Cathedral*, *Rogue Herries*, and *Judith Paris*. *The Cathedral* was dramatised. In 1932 he published *The Fortress*.

WALPOLE, Sir Robert, Earl of Orford. English statesman. A younger son of Sir Robert Walpole, member of Parliament for Castle Rising, he was born in 1676, and died in 1745. He was educated at Eton, and at King's College, Cambridge; succeeded to the paternal estate in 1700, and entered Parliament as member for Castle Rising. In 1702 he was elected for King's Lynn, became an active member of the Whig party, and soon distinguished himself by his business capacity, and by his easy, plausible, and dispassionate debates.

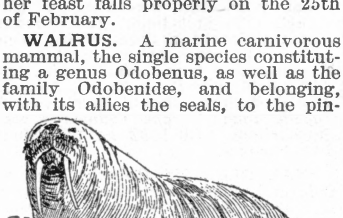
He was Secretary of War and leader in the Commons in 1708, Paymaster of the Forces in 1714 and 1720, and First Lord of the Treasury and Chancellor of the Exchequer in 1715, and

again in 1721. From the latter date until 1742 he held without interruption the highest office in the State. During his long administration the Hanoverian succession, to which he was zealously attached, became firmly established, a result to which his prudence and political sagacity largely contributed.

He promoted by an enlightened policy the commercial prosperity of the nation, and relieved the weight of taxation by many improvements in the tariff. In 1724 he was made a Knight of the Bath, in 1726 a Knight of the Garter, and on 9th Feb., 1742, two days before his resignation, he was created Earl of Orford. In an age famous for venality and lax morals he was the least corrupted, the soberest, and the hardest working of the leaders of both factions.—BIBLIOGRAPHY: Lord Morley, *Walpole* (Twelve English Statesmen Series); W. Coxe, *Memoirs of the Life and Administration of Sir Robert Walpole.*

WALPURGA, or WALPURGIS. A female saint, born in England early in the eighth century, died 779. As a niece of St. Boniface, and sister of St. Willibald, first Bishop of Eichstädt, Bavaria (741-786), she was induced to proceed to Germany to found convents, and in 754 she became abbess of Heidenheim, where she died. The eve of the 1st May, associated with some of the most popular witch superstitions of Germany, is called *Walpurgis-night*, but her feast falls properly on the 25th of February.

WALRUS. A marine carnivorous mammal, the single species constituting a genus Odobenus, as well as the family Odobenidæ, and belonging, with its allies the seals, to the pin-



Walrus

nigrade section of the order Carnivora. The walrus, which is also known as the morse, sea-horse, and sea-cow, has a general resemblance to the seals, but is especially remarkable from the upper canine teeth being enormously developed in the adults, constituting two large pointed tusks directed downwards and slightly outwards, and measuring usually 12 to 15 inches in length, sometimes even 2 feet and more. There are no external ears.

The animal exceeds the largest ox in size, attaining a length of 20 feet. It is monogamous, and seldom produces more than one young at a birth; gregarious but shy, and very fierce when attacked. It inhabits the high northern latitudes, where it is hunted by whalers for its blubber, which yields excellent oil; for its skin, which is made into a durable leather; and for its tusks. Their favourite food consists of crustaceans and bivalve molluscs.

WALSALL. A county and municipal borough of England, in the county of Stafford. The present town is almost entirely modern. Extensive coal, iron, and limestone deposits in the immediate vicinity, and ample canal and railway communication with leading trade centres, have made it an important manufacturing town. Brass- and iron-foundries are numerous and on a large scale; and for saddlers' and carriage-builders' ironmongery, tools, locks, and keys, etc., Walsall has long been famous. Pop. (1931), 103,102.

WALSINGHAM, Sir Francis. English statesman, born about 1530, died in 1590. After studying at King's College, Cambridge, he travelled on the Continent for some time, and acquired a good knowledge of foreign languages and politics. He was introduced by Cecil, Lord Burleigh, to public service, and employed in embassies to France, the Netherlands, and Scotland. He also sat in the House of Commons for various constituencies, and occupied important public offices.

His sagacity and discretion caused him to be much employed, often against his own desire, in the intrigues of Elizabeth, especially against Mary Queen of Scots. The unravelling of the Babington Plot was entrusted to Walsingham, and he was also one of the commissioners who tried Queen Mary.

WALTHAM. A city of Massachusetts, United States, in Middlesex county, on Charles River; served by the Boston & Maine railway. It is the seat of the Waltham watch manufactory, and also manufactures cottons, organs, and motor-cars. Settled in 1640, it became a city in 1884. Pop. (1930), 39,247.

WALTHAM ABBEY, or WALTHAM HOLY CROSS. A town of Essex, England, on the Lea. Part of an old abbey church founded by

King Harold in 1060 now belongs to the parish church. The abbey once possessed a miraculous cross. There are Government explosives factories. At Waltham Cross, in Hertford, 1¼ miles from Waltham Abbey, is one of Edward I.'s crosses. Pop. (1931), 7116.

WALTHAMSTOW. A borough of Essex, England, part of Greater London. It is the Domesday *Wealanestun*. It has been a borough since 1929. Pop. (1931), 132,965.

WALTHER VON DER VOGELWEIDE, one of the best mediæval German lyric poets of the class of *minnesingers*, was born about 1170, died at Würzburg about 1230. A politician and reformer as well as a poet, he was in favour of the Emperor as against the Pope, and by his songs influenced the art and politics of his time.

WALTON, Izaak. English writer, born at Stafford on the 9th Aug., 1593, and died at Winchester on the 15th Dec., 1683. He went to London, where he was apprenticed to an ironmonger. In 1614 he started for himself, and had a shop in Fleet Street, near Chancery Lane. He became a freeman of the Ironmongers' Company in 1618. His earliest literary productions were copies of verses prefixed to books written by his friends.

In 1626 he married the great-grand-niece of Archbishop Cranmer. She died in 1640; and in 1646 he married a stepsister of Thomas Ken, afterwards Bishop of Bath and Wells. He thus knew many Anglican clergy. Donne and George Morley, afterwards Bishop of Winchester, were among his intimate friends.

In 1640 he wrote a life of Donne, which was prefixed to an edition of his sermons; this was added to and issued separately in 1655. He also wrote lives of Sir Henry Wotton (1651), Richard Hooker (1665), George Herbert (1670), and Bishop Robert Sanderson (1678). Walton had known all these men except Hooker; he had been a close friend of Donne and Wotton; his acquaintance with Sanderson had been slighter; Herbert he had only met. His biographies are all good—indeed are all masterly—but he has done most justice to the men he knew most intimately.

Walton's masterpiece, however, is *The Compleat Angler*, which first appeared as a small octavo, price eighteenpence, in 1653. A second edition, containing twenty-one chapters (the first edition had only thirteen), came out in 1655. A third edition appeared in 1661, a fourth in 1664, a fifth in 1668, and in 1676 the work, with treatises by Venables and Charles Cotton, was given to the world as *The Universal Angler*. Since then there have been over a hundred editions.

Walton seems to have lived an ideally tranquil and happy life. Although a keen Royalist, he took no part in the Civil War, except to take care of King Charles's "Lesser George," or badge of the Order of the Garter, after the battle of Worcester. He retired from business in the prime of life, and lived to a great age, spending his time in fishing and in pleasant intercourse with his friends.

His biographies show him to us in a serious, work-a-day frame of mind; in *The Compleat Angler* we see him in holiday mood. His style is always natural and charming; the spirit which lives in the opening lines of Chaucer's *Prologue* animates all his work.

In his temperament, Walton is the last of the Elizabethans. *The Compleat Angler* has been criticised for giving no accurate information about fishing. It is no more a mere manual of fishing than the *Georgics* is a manual of agriculture. Walton is an idyllist; his work is an amplification of the text "Study to be quiet." The singular happiness of his nature has given immortality to his descriptions of the country.

WALTON ON THAMES. An urban district of Surrey, England, 5 miles from Kingston. Besides its attractive position on the Thames, it has a famous golf course. Pop. (1931), 17,953.

WALTON ON THE NAZE. A watering-place of Essex, England. Its importance has been reduced by the inroads of the sea, and in 1798 the parish church was destroyed by the tides. Near is Walton Mere, a noted resort of wild duck. Pop. (1931), 3066.

WALTZ. A widely popular dance in triple time. It is of German origin, being a development of the *ländler*, a country dance of similar style, but danced more slowly. The waltz originated in Bohemia, Austria, and Bavaria about the latter half of the eighteenth century, and is first met with in England about 1790. Both at home and on the Continent it was received with great hostility, but, nevertheless, won its way in time to universal favour, and during the nineteenth century it was the most popular of all dances.

Music for the waltz is written in the simplest of forms, consisting essentially of eight-bar phrases in pairs. Two phrases suffice for the simple requirements of the *ländler*,

the best examples of which are to be found in the *Deutsche Tänze* of Beethoven and Mozart. The waltzes of Schubert are mainly written according to the same plan, but show an artistic development in their wider harmonic scheme and their variations from the regularity of the eight-bar phrases.

Weber in his *Invitation to the Dance* completed the emancipation of this form from the mechanical requirements of the ballroom, and made of the waltz a developed piece of music. Chopin and Brahms are the two greatest waltz-writers. For purposes of dancing the waltzes of Johann Strauss are pre-eminent, with those of Gung'l and Waldteufel not far behind. For modern dancing, however, the music is mainly jazz, and the most modern waltzes are of this type.

WALVIS BAY, or **WALFISCH BAY.** The chief seaport of the territory of South-West Africa, a nodal point of the territorial railways. It is 21 miles south of Swakopmund, the former German port which has been more or less silted up by the Benguella current, and is developing as a health resort. The mean annual temperature at Swakopmund (20 feet altitude) is 59·5° F. (March, 63·5°; May, 70°; August, 55° F.), and the rainfall 0·7 inches (0·2 inches in March and December, 0·1 inches in October and February, and practically none at all during the rest of the year).

In March, 1878, Walvis Bay and the circumjacent territory became British, and was annexed (1884) to Cape Colony, Britain thus possessing herself of the best port of entry to German South-West Africa, of which Walvis Bay was an enclave until the termination of the local operations during the European War. There is a 3½ kw. wireless station. Pop. 3100 *See* SOUTH-WEST AFRICA.

WANDEROO (*Macăcus silēnus*). A monkey inhabiting Ceylon and the East Indies. The length is about 3 feet to the tip of the tail, which is tufted, and much resembles that of the lion; the colour of the fur is deep black; the callosities on the hinder quarters are bright pink; a well-developed mass of black hair covers the head, and a great greyish beard rolls down the face and round the chin. The same name is given in Ceylon to a species of Semnopithecus.

WANDSBEK. A town of Prussia, Germany, on the Wandse. It is a suburb of Hamburg. Pop. 39,606.

WANDSWORTH. A south-western metropolitan borough of the county of London, comprising the parishes of Streatham, Lower Tooting, Putney, and Clapham. Pop. (1931), 353,101.

WANGANUI. A seaport of North Island, New Zealand, on Wanganui River. Pop. (1932), 27,800.

WANKIE. A township of Southern Rhodesia. It is a coal-mining centre. Pop. (white), 555.

WANTAGE. A town and agricultural centre of Berkshire, England. It is the birth-place of King Alfred, and was a residence of the Saxon kings. There is a grammar-school. Pop. (1931), 3424.

WAPENTAKE. The name formerly given in some of the northern shires of England, and still given in Yorkshire, to a territorial division of the county, corresponding to the *hundreds* of the southern counties.

WAP'ITI. A species of deer, the North American stag (*Cervus canadensis*), which more nearly resembles the European red-deer in colour, shape, and form than it does any

Wapiti

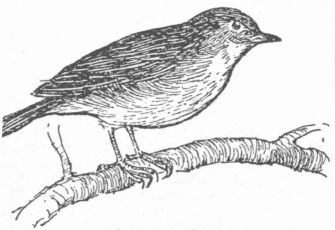
other of the cervine race, though it is larger and of a stronger make, its antlers also being larger. It is found in Canada and the northern parts of the United States from the Atlantic to the Pacific. Its flesh is not much prized, being coarse and dry, but its hide is made into excellent leather.

WARBECK, or OSBEC, Perkin. A pretender to the English throne, born about 1474, died in 1499. He was set up by Margaret of York, Dowager-Duchess of Burgundy, as a pretender to the crown of England against Henry VII. For this purpose she recognised

as her nephew, Richard Plantagenet, Duke of York, the younger of two princes who were murdered the Tower by Richard III.

He was patronised by France and Scotland, married a kinswoman of Scottish king, James IV., made several fruitless invasions of England and Ireland, was taken prisoner after an attempt on Cornwall (Oct., 1497), and confined to the Tower, where, his plotting being continued, was executed (Nov., 1499).—Cf. James Gairdner, *Richard III. and the Story of Perkin Warbeck.*

WARBLERS (Sylviinæ). The name applied to a sub-division of the thrush family, generally small, sprightly, very gay, and remarkable for the clearness,



Warbler (Garden)

sweetness, and flexibility of their song. The typical warblers belong to the genus Sylvia (q.v.).

WARBURTON, William. British prelate, born at Newark-upon-Trent in 1698, died at Gloucester in 1779. He was brought up to the law, but not finding this profession to his taste he relinquished it, and in 1723 took deacon's orders in the Church. In 1727 he began to distinguish himself as a writer by his inquiry into the *Causes of Prodigies and Miracles.* This led to his being presented to the rectory of Brand Broughton, in Lincolnshire.

In 1736 appeared his first important work, the *Alliance between Church and State*, etc., which brought him into favourable notice at court; but his great work is the *Divine Legation of Moses.*

A defence of Pope's *Essay on Man* secured him the friendship of the poet, and he became a considerable beneficiary under the latter's will. In 1746 he was appointed preacher to the society of Lincoln's Inn, and from that time his advance in Church preferment was rapid, until he became Bishop of Gloucester in 1759.—Cf. J. S. Watson, *Life of William Warburton.*

WARD, Sir Joseph George. New Zealand statesman, born in Melbourne, 26th April, 1857, he entered politics in 1887 as Liberal member for Awarua. He held office in the departments of customs, industries and commerce, marine, railways; was Postmaster-General and Colonial Secretary, 1899-1906; Prime Minister 1906-12; created a baronet in 1911; Minister of Finance in the National War Cabinet, 1915-9; and represented New Zealand at the Peace Conference, 1919; he was again Premier, Dec., 1928-May, 1930. He died in 1930.

WARD, Mary Augusta (Mrs. Humphry Ward). Novelist, granddaughter of Dr. Arnold of Rugby, born 1851, died 1920. Her chief novels include: *Robert Elsmere* (1888), a novel of religious doubts and perplexities; *The History of David Grieve*; *Marcella*; *Sir George Tressady*; *Helbeck of Bannisdale*; *Lady Rose's Daughter*; *The Marriage of William Ashe*; *Missing* (1917); and *Fields of Victory* (1919).—Cf. Janet Penrose Trevelyan (daughter), *Life.*

WARD. In English law, one who is under guardianship through want of full legal capacity, as an insane person or an infant (i.e. a person under twenty-one years of age). If the court has appointed a guardian or assumed protection of an infant without making such appointment, the ward is then called a "ward of court." Any infant against whom an action has been raised becomes a ward of court and entitled to its protection, though he has a guardian.

The consent of the court is necessary to the marriage of a ward of court. The court may remove a child from the custody of its father if its welfare so demands; may dismiss any guardian who has acted dishonestly or improperly in his trust; and may assume control of the ward's estates.

The term "ward" is also applied to an electoral division of a county, parish, city, or borough for purposes of local government.

WAR DEBTS. National debts in general are mostly war debts, but the term is specifically applied to the inter-governmental indebtedness arising out of, and in connection with, the European War, 1914-18. It covers both the financial transactions of the allied and associated Powers with one another, and also the financial penalties imposed upon the losers of the war by the Peace Treaties. *See* REPARATIONS.

The War involved the allied and associated Governments in complicated financial transactions, the net result of which was that all of them stood in the position of debtor to the

Government of the United States. Great Britain's part in the war was financed, as to about one-third (36 per cent), by taxation and other revenue collections, and the remainder by internal and external loans. The British war debts included very large loans obtained on behalf of allied Governments, and advances made to Dominion Governments and colonies. Out of a total British debt of about £7,973,000,000 dealt with in the 1920 Budget, about £1,851,000,000 (increased in the following financial year to approximately £1,886,000,000) represented advances to other Governments.

The funding agreements made at various dates between 1923 and 1925 by the principal debtors with the United States Government will serve to show the net war debt position of the allied nations. The British debt to the United States was funded, in December, 1922, at $4,604,128,000, of which $525,182,000 was funded accrued interest, and the agreement provided for payment of annuities up to 1984, to a total of $11,105,965,000. France funded at $4,025,387,000 in April, 1926, and the total annuities payable, up to 1987, amounted to $6,847,674,000. Belgium's debt, funded in August, 1925, totalled $417,797,000, the total annuities payable up to 1987 amounting to $727,831,000; Czechoslovakia, a total funded debt of $115,000,000, with total annuities of $312,811,000 up to 1987; Estonia, $13,831,000, total annuities, payable 1984, $33,331,000; Finland, $9,009,000, total annuities, payable by 1984, $21,695,000; Italy, $2,042,199,000, total annuities, payable 1987, $2,407,678,000; Latvia, $5,780,000, total annuities by 1984, $13,959,000; Yugoslavia, $62,857,000, total annuities by 1987, $95,178,000; Poland, $178,565,000, total annuities by 1984 $435,688,000; Lithuania, $6,032,000, total annuities, payable by 1986, $14,532,000; Rumania, $44,594,000, total annuities by 1987, $122,506,000. The United States is creditor also of Greece and Hungary, in respect of funded debts amounting to $18,128,000 and $1,940,000 respectively. The grand total of the annuities receivable by United States in respect of all these funding agreements amounted to $22,162,996,000.

The funding arrangements made by the United States Government were originally directed by Congress to be made at a rate of interest not less than 4½ per cent per annum. This was altered by Congress in 1923 as too onerous, and the earliest debt settlement, made with Great Britain in December, 1922, bore 3 per cent interest rising after ten years to 3½ per cent, and this was the standard for a number of the funding agreements; but the agreements with France, Belgium, Italy, Yugoslavia, and Greece, made later, provided for much lower rates of interest—the average rate payable by France being no more than 1·6 per cent and by Italy 0·4 per cent.

The position of Great Britain in respect of war debts is an exceptional one. By the date of America's entry into the war in April, 1917, Britain had advanced about $4,000,000,000 (£827,000,000 at par) to her allies, and following America's entry, a further sum of about £750,000,000 was loaned to the allies by the British Government; its borrowing from the United States in the same period amounting to about £850,000,000. The method of accountancy adopted was for the United States Government to advance only the dollars required in excess of the amount of dollar assets available to Great Britain (and other allied Governments) in the United States as a result of inter-governmental transactions in providing for the American army abroad, and other dollar resources that could be accumulated to liquidate purchases in America. The net result, however, as indicated above, was that Great Britain found herself heavily indebted to the United States on the one hand, and a creditor for very large amounts in respect of other allied Governments, Dominion Governments and colonies.

Funding arrangements with the allied countries were made by the British Government by August, 1927, with the result that France's debt was funded at £599,628,000, payable by 1988 in annuities totalling £799,500; Italy, £560,000,000, total annuities £276,750,000 by 1987; Yugoslavia, £25,591,000, total annuities, £32,800,000; Greece, £21,441,000, total annuities, £23,550,000; Rumania, £18,448,000, total annuities, £31,250,000; Portugal, £20,134,000, total annuities, £23,975,000. Russia's debt to Great Britain totalling £423,321,000, which with accumulated interest was estimated to amount to £953,000,000 in 1931, has never been funded, and Belgium's debt of £90,084,000 was included in Germany's reparations debt.

British policy in respect of war debts owing from the allies was set forth originally by Mr. Lloyd George, as Prime Minister, in 1920, in a letter to the President of the United States; in this, after pointing out that Great Britain had borrowed from the United States about half as much as its total loans to allies, Mr. Lloyd George stated that the British Government would agree to any equitable arrange-

for the reduction or all-round
illation of inter-allied indebted-
but that such arrangement must
be one-sided. Two years later,
922, the Earl of Balfour, as
ign Minister, addressed to the
l Governments an identical Note
aining that debt settlements with
must depend on what Great
ain had to pay America; the
sh Government's policy, Lord
our stated, was to surrender its
e of German reparations and
e off, through one great trans-
on, the whole body of inter-allied
btedness; but if this were found
be unacceptable, the British
ernment in no circumstances
ld ask more from its debtors than
necessary to pay its creditors.
there was no response to this
r, the British Government pro-
ded to fund its debt with the
ted States and, as stated, to make
ding agreements with its allied
tors; which, however, will yield
at Britain less than half of what
must pay, although she loaned
re than half of what she borrowed;
l her receipts in respect of her
otors would only have equalled
payments to the United States
Britain's share of German repara-
ns had been paid.

The position of the war debts was
ade more complicated by the diffi-
lties encountered in obtaining
yment of reparations from Ger-
any (*see* REPARATIONS). These
fficulties produced first the "Dawes
an" and then the "Young Plan"; e former (framed in 1924) laid down five-year scheme of annuities, sing from 1,000,000,000 gold marks 1924-25 to 2,500,000,000 in 1928-), after which payments were to be odified. This plan was altered by ie Young scheme in 1929 which xed the payment of annuities at ,707,900,000 gold marks for the first ill year, rising to 2,428,800,000 in 965-66. Reparations were suspended long with the annuities on account f allied war debts by the Hoover noratorium which postponed pay-nent for one year, 1931-2. In July, 932, the position was again altered by the Lausanne Agreement (q.v.) which ended the payment of reparations by Germany, to all intents and purposes, by a final contribution from Germany of 5 per cent redeemable bonds to the amount of three milliard reichsmarks, gold, to be negotiated under prescribed conditions by the Bank for International Settlements.

The Lausanne Agreement embodied the efforts of the European Powers concerned with reparations to clear the way for a settlement of the whole question of war debts with the United States. In form ratification of the Agreement was conditional upon such a settlement being reached. The American Government, however, is bound by a resolution of the Congress, adopted in December, 1932, which expressly declares it to be contrary to the policy of Congress that "any of the indebtedness of foreign countries to the United States should be in any manner cancelled or reduced" and explicitly stating that favourable consideration will not be given "at any time" to a change in the policy thereby declared.

Payment of the annuities due from allied debtors entered in 1932 upon a critical phase: those due in December, 1932, were paid by Great Britain, Italy, and one or two others, but withheld by France, Poland and Belgium. The British decision to pay was accompanied by an intimation that the amount was not to be regarded as a resumption of the annual payments contemplated by the original agreement but as a "capital payment of which account should be taken in any final settlement". The American Government replied that this condition it was not in a position to recognise, but the payment was made. France's default, or suspension of payment pending negotiations, caused the downfall of the Herriot Government (q.v.).

The war debts question reached a crisis in June, 1933, when the half-yearly instalments again fell due. Reminded by the United States Government that payment was expected of $75,950,000, the British Government recalled its December intimation that it proposed to treat the payment then made as a capital payment, and announced its intention to pay $10,000,000 "as an acknowledgment of the debt pending a final settlement". The American Government replied that it was not within the President's discretion to reduce or cancel the existing debt or to alter the schedule of payments, but noting that the payment offered was accompanied by a clear acknowledgment of the debt itself President Roosevelt announced that he did not regard the resultant situation as a default on the part of this country. Mr. Roosevelt also invited the British Government to send representatives to Washington to discuss the debt question.

WARE. A market town of England, in Hertfordshire, on the Lea. The chief industries are brick-making and malting for the London breweries. The Great Bed of Ware, formerly at the Saracen's Head Inn, has been

removed to Rye House near Hoddesdon. Pop. (1931), 6171.

WAREHAM. A municipal borough of England, in Dorsetshire, near the mouth of the Frome. The churches of St. Mary and St. Martin are both old; in the former is the coffin of Edward the Martyr. Pop. (1931), 2057.

WAR GRAVES. Burial places of those who fell in the World War. The largest number are in France; others being in Belgium, Italy, Greece, Egypt, and Palestine. The War Graves are cared for by a permanent commission, and each country has set aside a sum to provide for their maintenance.

WAR LOANS. The sums of money borrowed by a Government for the purpose of financing a war. In so far, however, as this borrowing is carried out by means of Treasury Bills, or by private transactions with the Bank of England and the joint-stock banks, it is not customary to use the term War Loan, which is, in practice, confined to the funded debt taken up by the general public.

Early in the European War, i.e. Nov., 1914, a £350,000,000 War Loan at 3½ per cent was issued, but drew very little response from the public, and a large part of it was taken up by the Bank of England and subsequently repaid out of the proceeds of the War Loan of 1915. In June of that year a 4½ per cent War Loan was issued, which, including conversions of 3½ per cent War Loan, Consols, etc., produced total applications for £900,000,000, and actual cash receipts of £585,000,000.

In Oct., 1916, £150,000,000 6 per cent Exchequer Bonds, repayable in Feb., 1920, were issued. In 1917 a great 5 per cent War Loan was issued, which realised over £1,000,000,000; while in the second half of 1917 a system of continuous borrowing by the issue of National War Bonds was instituted. By these means the British National Debt increased between 1913 and 1919 from £706,000,000 to £7,832,000,000.

In 1932 the amount of War Loan outstanding was £2,084,994,000, and in June of that year the Government launched a scheme for the conversion of the loan from 5 per cent to 3½ per cent, offering a bonus to holders who assented before 31st July. The scheme was entirely successful, and by 1st Oct., 1932, 92 per cent of the loan had been converted.

WARMINSTER. A market town of Wiltshire, England, on the west side of Salisbury Plain. It is an agricultural centre, and has some small manufactures. The chur St. Denys is of interest. Pop. (1 5176.

WARNER, Susan. American w born 1819, died 1885. In 185 published, under the pseudony Elizabeth Wetherell, a story o "goody-goody" sentimentally thetic order entitled *The Wide, World*, which was highly popula both sides of the Atlantic. *Qu* (1852) was almost equally so, her other books had no great suc

WARNER, William. An En author, born about 1558, studie Oxford, became an attorney and of letters in London, died in 1609. 1585 he published seven tales u the collective title of *Pan, his Sy or Pipe*; but his principal wo the one which has kept his n alive—is *Albion's England*, a p in fourteen-syllable lines, first p lished in four books (1586), af wards extended to sixteen, dea with the history of Britain from days of Noah to James I., and c taining an extraordinary hotch-po of mythology, legend, and more less genuine history and biograp etc. Warner also published a tra lation of the *Menœchmi* of Plaut which Shakespeare may have s in manuscript before he wrote *T Comedy of Errors*.

WAR OFFICE. A British St department charged with the du of carrying out the considered opini of the supreme military authorit the Army Council. The Army Cou cil consists of a president (the Secr tary of State for War) and nine mer bers, of whom five are serving soldier The head of the War office is also t Secretary of State for War.

At the head of each of the ma departments into which the W Office is divided is a member of t Army Council, e.g. the departmer of the Chief of the Imperial Gener Staff is presided over by the office holding that appointment. Similarly the departments of the Adjutant General to the Forces, the Quarter master-General to the Forces, an the Master-General of the Ordnanc are all in charge of members of th Army Council.

These, with the Deputy-chief of the Imperial General Staff, make up the five military members of the Army Council as above. Then comes the department of the Under-Secretary of State for War and the Finance department, both of which are in charge of members of Parliament (of either House), and finally the Secretary's department, at the head of which is one of the joint-secretaries of the War Office, both of whom are

members of the Army Council. The other joint-secretary is a member of the Finance department.

Each of these main departments is further divided up into directorates, each under a general officer. For instance, in the department of the C.I.G.S., are the directorates of military operations, military intelligence, and Staff duties; in that of the Adjutant-General to the Forces are directorates of organisation, personal services, army medical services, hygiene, and pathology; under the Quartermaster-General are the directors of movements and quarterings, remounts, supplies and transport, equipment and ordnance stores, and veterinary services; while the Master-General of the Ordnance deals with a director of artillery, a director of fortifications and works, and a director-general of factories. This is the principle of the delegation of responsibility which is constant throughout the army. *See* ARMY; STAFF.

WARRANT. An instrument or document authorising certain acts which without it would be illegal. Warrants may be divided into royal or executive, judicial, and commercial warrants. The first include *Death, Extradition, Royal Arms* (authority to use the royal arms), and *Treasury Warrants* (authority to receive payments at the Treasury).

Common forms of judicial warrants are: the *Warrant of Arrest*, usually issued by a justice of the peace for the apprehension of those accused or suspected of crimes; the *Warrant of Commitment*, a written authority committing a person to prison; the *Distress Warrant*, a warrant issued for raising a sum of money upon the goods of a party specified in the warrant; the *Search Warrant*, an authority, generally granted to police-officers, to search private premises. Commercial warrants usually authorise the delivery of goods or money, such as *Dock-warrants, Dividend Warrants*, etc.

WARRANT-OFFICER. In the army, an intermediate rank between commissioned officers and non-commissioned officers. Warrant-officers, as the term implies, are appointed by "warrant" issued by the War Office. Promotion to warrant rank takes place on the application of the commanding officer of the unit on the occurrence of a vacancy. The following among others are warrant officers: conductors, Royal Army Ordnance Corps; master-gunners, first-class; regimental sergeant-majors; band-masters; and certain schoolmasters.

Warrant rank in the Royal Marines is practically identical with the same rank in the army, but in the Royal Navy warrant-officers rank next below commissioned officers, are entitled to the salute, and wear uniforms that are only to be distinguished from those of commissioned officers by the buttons on the sleeves, the width of the gold-lace band, and the wearing of plain shoulder-straps.

WARRANTY. In law, a guarantee or security; a promise or convenant by deed, made by a bargainer for himself and his heirs, to warrant or secure the bargainee and his heirs against all men in the enjoyment of an estate or other thing granted.

WARRINGTON. A municipal, parliamentary, and county borough of Lancashire, England, with a small portion in Cheshire. It stands on the Mersey, about midway between Liverpool and Manchester. River, canal, and railway communication secure it exceptional carrying facilities. Tanneries, iron-, glass-, and soap-works, cotton-mills, and breweries are numerous and extensive. A dock exists near Warrington in connection with the Manchester Ship Canal. Pop. (1931), 79,322.

WARRNAMBOOL. A seaport-town of Victoria, Australia, 166 miles by rail south-west of Melbourne. It lies in a fertile agricultural district, and has an extensive trade in wool, flour, and dairy produce with Melbourne. Pop. (1931), 8200.

WAR'SAW (Pol. *Warszawa*; Ger. *Warschau*; Fr. *Varsovie*; Russ. *Varshava*). The largest city of Poland, the republican capital, extending for over 5 miles along the left bank of the Vistula; served by rail to Bialystock, Deutsch-Eylau, Lodz, Kraków (Cracow), etc., and by steamers on the Vistula downstream to Thorn (Torún) and upstream to Sandomir (Sandomierz). Two bridges connect it with Praga, a suburb on the right bank of the river containing the two termini of the eastern railways.

Warsaw is famous for its huge churches, numerous and magnificent palaces and monuments, remnants of former Polish grandeur; for its educational institutions; and for its many and extensive gardens, parks, and suburban drives. It was formerly also exceptionally rich in literature and art treasures; most of which were removed by the Russians to Leningrad.

Leather, boots and shoes, woollen and linen stuffs, plated ware, machinery, beer, potato-starch, locomotives, paper, and tobacco are some of the most important industrial products, and in the district toys, musical and surgical instru-

ments, gloves, artificial flowers, flour, glassware, and watches are manufactured. There is a Government printing-works at Warsaw. It has two broadcasting stations (1411 m., 120 kw., and 214·3 m., 1·9 kw.). Pop. (1931), 1,178,211.

WART (Verruca). A small papillary excrescence of horny character most frequently seen on the hands, but occurring on any part of the body. Some types are undoubtedly contagious, but no germ has as yet been discovered.

In treatment of warts great care should be taken in the use of strong acids, and if acids are used in liquid form the best is acetic. A slow, but painless and usually successful, method is the repeated application of salicylic-acid plaster.

WARTBURG (vârt′ burh). An ancient mountain castle in Germany, near Eisenach, in Saxe-Weimar. It was built in 1067 as a residence for the landgraves of Thuringia. Here, according to the legend, took place the poetic contest known as the "War of the Wartburg," between Walther von der Vogelweide and six other eminent poets of Germany, in 1206. It was the residence of Luther in 1521-2, and the room in which the great reformer worked at the translation of the Bible is still shown.

WARTHE′ (vâr′tê), or **WARTA.** A river of Germany. It rises in Poland, 35 miles north-west of Cracow, and joins the Oder at Küstrin. Total length, 450 miles, of which 220 miles are navigable.

WART-HOG. A name common to certain members of the hog family, genus Phacochœrus, distinguished from the true swine by their dentition, which in some respects resembles that of the elephant. The head is very large; immense tusks project from the mouth outwards and upwards, and the cheeks are furnished with flesh-like excrescences resembling warts. They feed on the roots of plants, which they dig up with their tusks. The African wart-hog or haruja (*P. africanus*) of Abyssinia, and the vlackevark of the Dutch settlers of the Cape (*P. æthiopicus*) are distinct species.

WARTON, Thomas. English poet and critic, born at Basingstoke 1728, died at Oxford 1790. He was educated at Winchester, and Trinity College, Oxford, and early distinguished himself by his poetical compositions and criticisms. He was chosen professor of poetry at Oxford in 1757, a chair he filled with great ability for ten years; appointed Camden professor of history in 1785; and succeeded Whitehead as Poet Laureate in the same year. He rendered great service to literature by his *History of English Poetry* (1774-81; 3 vols.), a work never completed.

WARWICK, Richard Neville, Earl of, "the kingmaker." English nobleman, born 1428, killed 1471. He was the son of an Earl of Salisbury, and became Earl of Warwick by marrying the heiress of the title and estates. Taking the Yorkist side in the Wars of the Roses, he was the main instrument in placing Edward IV. on the throne (1461) in place of Henry VI., and became the most powerful nobleman in the kingdom.

Quarrelling with Edward on account of the latter's marriage, he went over to Henry's side, and was able to place him again on the throne, but was defeated and slain at the battle of Barnet.—Cf. Sir C. W. C. Oman, *Warwick, the King Maker.*

WARWICK (wo′rik). A municipal borough of England, on a rocky hill on the right bank of the Avon, the county town of Warwickshire. The principal object of interest is Warwick Castle, the most magnificent of the ancient feudal mansions of the English nobility. Pop. (1931), 13,459.

WARWICKSHIRE. A midland county of England; area, 902 sq. miles. The surface is undulating and drained chiefly to the Avon and the Tame. There is a large amount of pasture for dairying and grazing purposes. Coal and several kinds of building-stone are abundant. Warwickshire is also famous for its manufactures, and includes the two great manufacturing towns of Birmingham and Coventry. Pop. (1931), 1,534,782.

WASH, THE. A large estuary on the east coast of England, between the counties of Norfolk and Lincoln. When the tide is full, the whole is under water; when out, large stretches are dry. Boston Deeps and Lynn Deeps give access to sea-going vessels.

WASHINGTON, George. First President of the United States, "the father of the Republic," born in Westmoreland county, Virginia, 22nd Feb., 1732, died at Mount Vernon 14th Dec., 1799. He was the great-grandson of John Washington, an Englishman, who emigrated in 1657, and the son of Augustine Washington, a substantial farmer. His education was limited, but he acquired a fair knowledge of mathematics and surveying, chiefly by self-study, and when his widowed mother prevailed upon him to abandon the idea of entering the British navy, he adopted surveying as a profession.

His military career commenced at

age of nineteen, when he was ointed adjutant-general of Vir-ia militia; and before long he wed in operations against the nch that he united in an eminent ree the qualities belonging to a cessful commander, though in 54, when in command of his regi-nt, he had to capitulate to a supe-r French force.

In 1755 he accompanied General addock as a volunteer, and was nost the only officer who returned 'e from the disastrous expedition. 1758 he took an important part the expedition that captured Fort 1 Quesne, where Pittsburg now ands. In the meantime extensive tates and plantations at Mount ernon had come into his possession rough the death of his half-brother. o these possessions he added largely y marrying, in 1759, Mrs. Martha ustis, a wealthy young widow.

Shortly after the outbreak of the War of Independence, Washington as elected Commander-in-Chief of ne American forces (5th June, 1775), 1 which capacity his career belongs o the general history of his country. t is sufficient to say that the struggle vas carried on by him under extra-rdinary disadvantages, including nfriendliness on the part of officers.

When peace was signed in 1783 Washington retired to Mount Vernon, nd refused all recompense for his nvaluable services beyond his per-sonal expenses. In 1787 he was a member of and presided over the Convention which met to revise the articles of union between the states, the result being the Constitution which is still in force, and which was adopted in 1788.

Washington was elected the first President of the Republic, and in-augurated 30th April, 1789, and he was again elected in 1793. During both terms he performed the duties of his office with marked ability, and the advances in prosperity made by the young Republic were extra-ordinary. At the close of his second term of office he resigned (1797), but when a misunderstanding with France threatened further trouble Congress appointed him Lieutenant-General of the Forces (1798).

Washington had a mind far above party strife, and was mourned by men of all parties. He had no family. Mount Vernon, on the Potomac about 15 miles from Washington, became national property in 1858. His remains are deposited in a vault in the grounds.—BIBLIOGRAPHY: Wash-ington Irving, *Life of George Wash-ington*; H. C. Lodge, *George Wash-ington*; C. Sheridan Jones, *A Short Life of Washington*; W. C. Ford (editor), *The Writings of George Washington*.

WASHINGTON. A maritime state in the Pacific Division of the United States, abutting on the British Columbia frontier. It is divided into two physical regions by the volcanic mountains of the Cascade range, which trend roughly from north to south. In the east is the plateau region, drained by the Columbia River (q.v.) and the Snake, its tributary. The former forms for about 300 miles the boundary of the state with that of Oregon, and its estuary provides the best harbour on the state's 180-mile stretch of coast-line on the Pacific.

There is, however, in the western region over a thousand miles of coast-line on Puget Sound, the submerged northern end of the great valley that

Washington: The Capitol

runs southwards into Oregon. On Puget Sound are found Olympia, the state capital, Seattle (the chief city), Tacoma, Bellingham, and Everett; Aberdeen (on Gray's Harbour on the Pacific coast), Spokane, and Walla-Walla are other cities.

Communications. There were in 1932 5523 miles of ordinary and 904 miles of electric railways, and ship-ping traffic on the Columbia and Snake Rivers and trans-Pacific are highly developed.

Production. Agriculture is pro-gressive, assisted by irrigation in the eastern region. Besides the customary cereal and root crops, dairying, sheep-farming, and general stock-raising, there is a large fruit-growing industry, and the timber resources are extensive. Gold, silver, copper, zinc, lead, antimony, arsenic, etc., are found, but coal is the chief mineral, 1,810,000 tons being produced in 1931.

Population. Of a total population (1930) of 1,563,396, 6840 were negroes, 23,642 Asiatics, and 12,572 Indians, the latter occupying 1330 sq. miles (18 reservations).

Education. Primary education is free and compulsory between the ages of eight and fifteen years, and there are two universities (Washing-ton, near Seattle, and Puget Sound, at Tacoma), as well as a State college

of science and agronomy at Pullman. State area, 69,127 sq. miles (2291 sq. miles being water).

Constitution. Washington was created a territory in 1853 and became a state of the Union in 1889. There is a bicameral Legislature, comprising a Senate and a House of Representatives, Senators being elected for four years (one half of the Senate seeking re-election biennially), and Representatives sitting for two years. There are 39 counties. Two Senators and 6 Representatives are sent to Congress.

WASHINGTON. The capital of the United States, in the District of Columbia, at the confluence of the Anacostia with the Potomac, 200 miles south-west of New York. The site was selected in 1790 by Washington himself, and the plan of the city was drawn up on a most magnificent scale. The streets cross each other at right angles, and are intersected diagonally by avenues.

First among the numerous public buildings ranks the Capitol. It accommodates Congress and the Supreme Court. The buildings provided for the various State departments (Treasury, Post Office, etc.) are also on a splendid scale. In the midst of these palatial offices stands the more modest yet elegant White House, the residence of the President. In addition may be specially mentioned the Smithsonian Institution, the Columbian College, the arsenal, the navy-yard, the Lincoln Memorial, and the Washington obelisk, built of white marble and blue gneiss, 555½ feet high, with a base 104 feet square. The city is protected by numerous forts and batteries, the harbour defences especially being of a formidable description. Pop. (1930), 486,869.

WASHINGTON CONFERENCE. In 1921 the President of the U.S.A. invited Britain, France, Italy, and Japan to participate in an international conference to discuss the question of the limitation of armaments, and the Pacific Problem. The conference met at Washington on 12th Nov., 1921, Mr. C. E. Hughes, U.S. Secretary of State, was appointed permanent chairman, and the concluding address was delivered by President Harding on 6th Feb., 1922.

Amongst the achievements of the Conference were: the Four-Power Pacific Treaty (signed by Britain, U.S.A., Japan, and France), replacing the Anglo-Japanese Alliance; the Five-Power Treaty prohibiting the use of submarines in attacking merchant ships, and the use of poison-gas in warfare; the Five-Power Naval Limitation Treaty (signed by Britain, U.S.A., Japan, France, and Italy); the settlement of the Shantung dispute between Japan and China (by this Japan, in 1922, returned the Shantung territory, including Kiao-chow, to China; by similar arrangements Britain agreed to restore Wei-hai-wei, and France to return Kwangchow, but negotiations are still proceeding); and the arrangement of Tariff and Open-Door Treaties regarding China. Under the Limitation Treaty Britain was allowed to complete only two capital ships (of 35,000 tons displacement) between 1922 and 1925, with no new building thereafter till 1931. The treaty restricts the total and individual tonnage of capital ships and aircraft-carriers, but does not affect cruisers, destroyers, and submarines.

WASH'ITA. A river of the United States, in Arkansas and Louisiana, an affluent of the Red River; length, 600 miles.

WATCH (nautical). A certain part of the officers and crew of a vessel who together work her for an allotted time, the time being also called a watch. The time called a *watch* is four hours, the reckoning beginning at noon or midnight. Between 4 and 8 p.m. the time is divided into two short or *dog-watches*, in order to prevent the constant recurrence of the same portion of the crew keeping the watch during the same hours.

WATCHET. Urban district and port of Somerset. It is 17¼ miles north-west of Taunton and 162¼ miles from London, on the G.W. Railway, and is situated on the Bristol Channel. There is a harbour for the fishing. Pop. (1931), 1936.

WATER. The commonest liquid in nature. It was classed among the elements until the close of the eighteenth century, when Lavoisier, profiting by the experiments of Cavendish, proved it to be a compound of hydrogen and oxygen, in the proportion of two volumes of the former gas to one volume of the latter; or by weight, 2 parts of hydrogen to 16 parts of oxygen; hence its formula is H_2O.

Pure water is a colourless, tasteless, inodorous liquid; a powerful refractor of light; a bad conductor of heat; and very slightly compressible, its absolute diminution for a pressure of one atmosphere being only about 50 millionths of its bulk. Pure water is a bad conductor of electricity, but if it is slightly acidulated with sulphuric acid, an electric current can be passed through

t, and the water is decomposed into its elements. Although water is colourless in small quantities, it is blue like the atmosphere when viewed in mass. It takes a solid form, that of ice or snow, at 32° F. (0° C.), and all lower temperatures; and it takes the form of vapour or steam at 212° F. (100° C.) under a pressure of 29·9 inches of mercury, and retains that form at all higher temperatures. Under ordinary conditions water possesses the liquid form only at temperatures lying between 32° and 212° F. It is, however, possible to cool water very considerably below 32° F. and yet maintain it in the liquid form. Water may also be heated, under pressure, many degrees above 212° F. without passing into the state of steam.

The specific gravity of water is 1 at 39·2° F., and this is the unit to which the specific gravities of all solids and liquids are referred, as a convenient standard, on account of the facility with which water is obtained in a pure state; 1 c. inch of water at 62° F. and 29·9 inches barometric pressure weighs 252·5 grains. In grammes per litre (1000 c.c.) the weights of *water* at 4° C., *hydrogen*, and *air* are respectively 1000, 0·0899, and 1·293 (the gases at 0° C. and pressure 76 cm. of mercury). Water is at its greatest density at 39·2° F. (= 4° C.), and in this respect it presents a singular exception to the general law of expansion by heat. If water at 39·2° F. be cooled, it expands as it cools till reduced to 32°, when it solidifies; and if water at 39·2° F. be heated, it expands as the temperature increases in accordance with the general law.

From the chemical point of view water is neither a distinct acid nor a base, it is neutral. It is decomposed by iron, zinc, magnesium, calcium, sodium, and potassium, the intensity of the action increasing from the first mentioned to the last. It forms definite compounds with numerous substances; thus it combines with lime to form slaked lime, and with sulphur trioxide to form sulphuric acid. Numerous crystalline compounds contain water in a state of combination, known as *water of crystallisation*, which is readily removed when the crystals are heated. Examples are blue vitriol, $CuSO_4$, $5H_2O$; washing soda, Na_2CO_3, $10H_2O$.

Of all liquids water is the most general solvent, and on this important property its use largely depends. In consequence of the great solvent power of water, it is never found pure in nature. Rain in passing through the air dissolves small quantities of the atmospheric gases, chiefly oxygen, nitrogen, and carbonic acid. It may also contain common salt and, near towns, compounds of sulphur. Where the rain-water has filtered through rocks and soils, and reappears as spring or river water, it is always more of less charged with salts derived from the earth, such as sea-salt, gypsum, and chalk. When the proportion of these is small, the water is called *soft*; when larger, it is called *hard water*. The former dissolves soap better, and is therefore preferred for washing; the latter is often pleasanter to drink.

The hardness of water is due to dissolved salts of calcium and magnesium. The hardness is *permanent* if the dissolved salts are chlorides or sulphates; but if the salts are bicarbonates, the hardness is *temporary*, and the water may be softened by boiling (which drives off the free carbonic acid, necessary to hold the bicarbonates in solution), or by Clark's process, in which slaked lime is added and reacts with the bicarbonates so as to form insoluble normal carbonates, which are precipitated, and can be removed. *See* FILTRATION; SEA-WATER; MINERAL WATERS; FREEZING; ICE; STEAM.

WATER-BEETLE. The name given to various species of beetles, having legs adapted for swimming, the two hinder pairs being flattened and fringed with hairs. A well-known species is *Dytiscus* (or *Dyticus*) *marginālis* of British ponds.

WATERBURY. A city of Connecticut, United States, a county seat of New Haven county, on the Naugatuck River; served by the New York, New Haven, & Hartford Railway. It is an important manufacturing town. Brass and brass goods are the staple products. Waterbury machine-made watches and clocks are known throughout the world. Electro-plate is also made. Settled in 1677, it became a city in 1853. Pop. (1930), 99,902.

WATER-CALYX. A curious condition found in some tropical flowers. The calyx forms a closed sac, and secretes from its inner surface—usually from special glandular hairs—a watery, slightly mucilaginous liquid, in which the other floral organs are immersed, until the flower is mature. When the flower opens, the liquid usually escapes or evaporates, owing to the bursting of the calyx; but in some Convolvulaceæ the water-calyx remains active until the fruit is ripe. Water-calyx is most frequent in the Bignoniaceæ, but also occurs in other families, such as Solanaceæ, Gesneraceæ, Vitaceæ, etc. Its

significance is obscure. *See* SPATHODEA.

WATER-COLOUR. A method of painting in which the pigments are mixed with water as a medium, gum with a little glycerine or honey acting as binding material. In this form colour may be applied to any non-greasy surface; but the most usual grounds are paper and card, though fabrics such as silk and ivory (in miniature painting) are often used. The medium being transparent, the colour and quality of the ground have considerable influence on the appearance of the painting; and in the case of superimposed layers of colour (known as *washes*) those underlying affect the apparent colour of those on the surface. This, and the fact that the essence of water-colour is careful preservation of the lights which are given by the untouched ground, separates the process from oil, in which the medium is more or less opaque, and the lights are painted on. Sometimes, however, the colours are mixed with opaque white (sometimes called *body-colour*), which gives it somewhat the quality of oil paint. In this form, water-colour is often known as *gouache*.

Used simply and directly, transparent water-colour has a delicacy and luminosity unrivalled by other media, though it lacks the range and intensity of oil. The best results are attained by broad washes, without attempts to modify or correct. In very skilful hands *washing-down* (lightening colour by repeated application of water), *scrubbing* (brisk rubbing of the moist colour with a rag or brush), and *scraping* (removing colour with a knife to lay bare the ground) are powerful weapons, but difficult to use. *Stippling* (the application of colour in small touches) permits elaboration of detail, but robs the medium of freshness and clarity.

Historical Survey. In the Far East, especially in China and Japan, water-colour has always been the principal medium employed. In Western Europe, however, its development as an independent art is comparatively modern. Both in transparent and opaque forms it was used in the illumination of manuscripts; and in the seventeenth century, especially in Holland, it became important in tinting drawings in chalk or ink, though it remained subsidiary to other media. In the eighteenth century, however, especially in England, it was much used by a group of topographic draughtsmen, who worked with the pen and coloured wash. Their work as a whole is prosaic and unimpressive, though occasionally a considerable artist emerges, such as the brothers Paul and Thomas Sandby.

But it was Alexander Cozens and his son, J. R. Cozens, who can claim to have freed water-colour from its trammels, and helped to make it an independent means of artistic expression. They paved the way for Thomas Girtin (1775-1802), the first great master in water-colour. His larger and more elaborate paintings fail in an attempt to rival oil; but the breadth of design and delicate luminosity of colour in most of his work remain unsurpassed. Turner, despite his matchless technical skill, approximated water-colour to oil, thereby losing at times its characteristic beauty; but J. S. Cotman (1782-1842) at his best rivalled Girtin in technical perfection and beauty of design, with the use of a wider palette.

With the foundation early in the nineteenth century of the Old Water-Colour Society (from which the present Royal Water-Colour Society sprang), the status of the water-colour painter may be regarded as assured. In David Cox and Peter de Wint, the medium found vigorous and able, if somewhat mechanical exponents. Partly inspired by Turner, however, and encouraged by Pre-Raphaelite methods, the middle of the nineteenth century witnessed an era of stippling and over-elaboration typified by the work of Birket Foster and A. W. Hunt; but in the 'eighties came a vigorous return to the older tradition, represented by the water-colours of Whistler, Tom Collier, and J. Buxton Knight. From this arose the contemporary school, which includes (among others) A. W. Rich, Wilson Steer, C. J. Holmes, D. S. MacColl, D. Y. Cameron, and David Muirhead. The chief rivals to British supremacy in the nineteenth century were the Dutch school of The Hague, represented by Mauve, Willem Maris, and Jacob Maris; and certain painters of Northern France, notably Henri Harpignies. But the art remains primarily British.—BIBLIOGRAPHY: C. E. Hughes, *Earlier English Water-Colour Painters*; A. J. Finberg, *The English Watercolour Painters*; A. W. Rich, *Watercolour Painting*.

WATER-CRESS (*Nasturtium officinale*). A cruciferous plant, distributed throughout Europe, Western Asia, North Africa, introduced into North America and certain British colonies, and choking some rivers of New Zealand, where the stem grows as thick as the wrist. It grows on the margin of clear streams, or even partly immersed in the water. It

has antiscorbutic properties, and is cultivated near many large towns to be used as salad, or otherwise.

WATERFORD. A county of Munster, Irish Free State; it has an area of 717 sq. miles, of which about a sixth is under tillage. The coast is in general bold and rocky, and besides the harbours of Waterford and Youghal, has the deep indentations of Dungarvan Harbour and Tramore Bay. The interior is largely rugged and mountainous. The principal rivers are the Suir and the Blackwater. There is a considerable extent of fine land in the south-east, and the hilly districts afford good pasture. Dairying is largely carried on. The fisheries are valuable. Pop. 78,538.

WATERFORD. A seaport-city of the Irish Free State, capital of the County of Waterford, on the Suir above its confluence with the Barrow, the estuary of the combined streams forming Waterford Harbour. There are large bacon-curing establishments, breweries, saw- and flour-mills, etc. The principal buildings are the Episcopal and Roman Catholic cathedrals. Pop. (1926), 26,646.

WATER-GAS. A combustible obtained by alternately raising hot solid fuel, such as coke, to incandescence by a blast of air, and then cooling it by the passage of steam through it to cause dissociation. Water-gas is commonly produced in gas-works, and is enriched with heavy hydrocarbon vapours, and used either by itself or mixed with ordinary coal-gas as a fuel. The simple untreated water-gas, or "blue" gas as it is termed, is sometimes used with coal-gas if the quality of the latter is above the normal. The temperature of the fuel is brought up to about 2000° F. before the steam is admitted, and drops to between 1500° and 1700° F. at the end of the run, after which the air-blast is used to raise it again. *See* FUELS.

WATER-GLASS, or **SOLUBLE GLASS,** consists of sodium silicate, and is prepared by fusing silica, in the form of sand or flint, with sodium carbonate, or with a mixture of sodium sulphate and carbon. The mass is extracted with water and concentrated to the consistency of a viscous syrup. It may also be prepared by heating finely divided silica, such as kieselguhr, with a solution of caustic soda under pressure. On treatment with acids, hydrated silica is precipitated. Water-glass is used for protecting stonework against weathering, in the manufacture of artificial stone, fire-proof cements, soap, etc., and also for preserving eggs.

WATERHOUSE, Alfred. British architect, born at Liverpool in 1830, died in 1905. He studied architecture in Manchester; was successful in the competition for Manchester Assize Courts, and designed Owens College and the Town Hall there. Among his chief works in London are the Natural History Museum at South Kensington, the New University Club, the National Liberal Club, the New St. Paul's Schools, and the City and Guilds Institute. He partly reconstructed Balliol College, Oxford, and Caius and Pembroke, Cambridge. He was a member of many foreign academies, and was elected R.A. in 1885.

WATERLOO'. A village of Belgium, nearly 10 miles S.S.E. of Brussels. It is famous for the battle which was fought there on 18th June, 1815, and which finally shattered the power of Napoleon. The Prussian defeat at Ligny, and his own unsuccessful engagement at Quatre-Bras on the 16th of June, caused Wellington to retire towards Waterloo, while Blücher concentrated his troops at Wavre, about 10 miles distant. The whole British position formed a sort of curve, the centre of which was nearest to the enemy. The French forces occupied a series of heights opposite, there being a valley of no great depth, and from 500 to 800 yards in breadth, between them. Each army probably consisted of about 70,000 men. The troops of Napoleon were for the most part veterans; while Wellington had an army composed of troops of various nationalities (Belgians, Brunswickers, Hanoverians, Nassauers) that had never fought together, and a great part of his British troops (about 25,000) were raw levies.

The object of Napoleon was to defeat the British, or force them to retreat, before the Prussians, who, he knew, were coming up, could arrive in the field; while that of the Duke of Wellington was to maintain his ground till he could be joined by his allies, when it might be in his power to become the assailant. The French began the battle about noon, and it continued with great fury till evening, when the appearance on the scene of the Prussians caused Bonaparte to redouble his efforts. His Imperial Guards, which had been kept in reserve, made a final attempt. Wellington's line, however, charged them at the point of the bayonet, and the Imperial Guards began a retreat, in which they were imitated by the whole French army. The British left the pursuit to the Prussians. The whole French army was dispersed and disabled. Their loss in killed, wounded

and prisoners amounted to between 40,000 and 50,000. The Allied loss amounted to 23,000 killed and wounded, of whom over 11,000 were British.

WATERLOO. Station in London. On the south side of the river, it is the headquarters of the Southern Railway. It was opened in 1848, and until the changes of 1921 was the headquarters of the L. & S.W. line. It was rebuilt in 1921-2, and with its 21 platforms is the largest of the London termini. There are connections by tube railways to all parts of London.

WATERLOO BRIDGE. Bridge over the Thames in London. It connects Wellington Street, Strand, to Waterloo Road. Built from designs by John Rennie, it was opened in 1817, and named in memory of the battle. It consists of nine arches. In 1924 the bridge began to give way, and in 1925 it was closed for repairs; a temporary bridge being built alongside for the traffic. It was proposed to build a new bridge, and the London County Council accepted the idea. There was, however, a good deal of opposition, and in 1932 the House of Commons refused to vote the necessary money.

WATERLOO WITH SEAFORTH. An urban district and watering-place of Lancashire, England, 4 miles north of Liverpool. Pop. (1931), 31,180.

WATER-PLANTS, or AQUATICS. Plants which grow partially or entirely submerged in water or floating thereon. Although Algæ are the most thorough-going water-plants, the term is commonly applied more especially to those relatively few Higher Plants that have reverted to aquatic life, such as water-lilies, Potamogeton, duck-weeds, Vallisneria, etc. These show many special adaptations, including lack of mechanical tissue, plentiful air-spaces, water-borne seeds and fruits, etc.; their flowers, however, are almost always borne above water.

WATER POLO. An aquatic sport, the popularity of which in Britain is attested by the growing number of the clubs devoted to its play; numbering but fifty in 1886, they had increased to six hundred in the first years of the present century. Official control is vested in the Amateur Swimming Association. A swimming-bath, the water being at least 3 feet in depth, affords a suitable "field." The width should not be more than 20 yards, and the length between goals from 20 to 30 yards. The ball is a little over 2 feet in circumference. Seven players form a side, and play lasts for two periods of seven minutes each. The possibilities of giving "fouls" are numerous.

WATER-POWER. *See* ENERGY; PHYSICAL; HYDRAULICS; HYDRO-ELECTRIC ENGINEERING; NITRIC ACID; POWER TRANSMISSION; RAINFALL; TURBINE, WATER.

WATERPROOF CLOTH. Cloth rendered impervious to water. There are numerous processes for waterproof fabrics of all kinds. The earliest patent, that of Macintosh (1823), consisted in covering cloth with a paste obtained by dissolving caoutchouc in benzol or coal naptha. In the treatment of cotton and linen cloth a small proportion of sulphur is generally added. A thin layer of this rubber solution is spread on the fabric by special machinery, after which the cloth is doubled, pressed, and finished in calenders, the waterproof layer being thus in the centre of the finished material.

Textiles thus manipulated become also impervious to air, and from a hygienic point of view unsuitable for prolonged personal wear. This led to the introduction of other solutions and methods of application intended to produce fabrics which, while resisting rain, do not altogether obstruct ventilation. Consecutive dipping of cloths in soap and alum solutions, or in gelatine and gall solutions, or in a solution of acetate of lead and then in a solution of alumina, has been resorted to with more or less success.

The substance called algin, obtained from sea-weed, has also been strongly recommended for the same purpose. There are also used for heavy fabrics solutions of paraffin wax and ceresine in benzene or petroleum benzene, ammoniacal solutions of various metals, and various sulphates and chromates of metal, as well as aluminium acetate, ammonium cuprate, and pitch or tar. A later patent process consists in treating the fibres in the solution instead of the manufactured textile, and the fabric thus produced, while rain-resisting, offers the same ventilation as ordinary materials.

WATER RIGHTS. There is no right of property in running water, but the owner of land over or through which water flows in a natural stream has the right of use as it passes, but must allow it to pass on to the neighbouring lands over or through which it flows not only in its proper channel but also in undiminished quantity and in unimpaired quality, except in so far as he has gained a prescriptive or other right to divert, diminish, or polute it. If he uses the water in

such a way as wrongfully to injure other interests, he is liable in an action of damages. But a proprietor who properly conducts mining operations on his own land and thereby drains away underground water from his neighbour is making a lawful use of his own property and is not liable in damages.

A grant of water conveys the rights of fishing and navigation, but not of property in the ground on which the water is. For the latter purpose it is necessary to convey the land itself, and a grant of land includes the water on it without express reference. A *prima facie* prescriptive right to a watercourse is acquired after twenty years' uninterrupted enjoyment, and an indefeasible right after forty years, but in the case of a navigable river not so as to defeat the rights of the public to use it for navigation.

WATER-SCORPION. The popular name of Nepa, a genus of hemipterous insects, the species of which inhabit ponds, etc. Some of them are powerful forms, 2 or 3 inches in length. They receive their popular name from the scorpion-like shape of the forelegs, with which they seize their prey.

WATER-SPOUT. A remarkable meteorological phenomenon frequently observed at sea. It is caused by the passage over the water of a whirlwind, which may have had its origin over a land surface. There is thus an ascending column of air rotating rapidly round an axis. Centrifugal force produces a partial vacuum in the centre. At the outside the ascending contained moisture is condensed to form a thick black cloud rotating round the axis with vertical motion. When this funnel-shaped column passes near the surface of the sea, the vacuum draws up into the vortex the sea-water, which joins in the whirling motion. The whole column, which after the junction extends from the sea to the clouds, assumes a magnificent appearance, being of a light colour near its axis, but dark along the sides.

When acted on by the wind, the column assumes a position oblique to the horizon, but in calm weather it maintains its vertical position, while at the same time it is carried along the surface of the sea. Sometimes the upper and lower parts move with different velocities, causing the parts to separate from each other, often with a loud report. The whole of the vapour is at length absorbed in the air, or it descends to the sea in a sudden violent downfall of rain. What are sometimes called *water-spouts on land*, or *cloud-bursts*, are merely heavy falls of rain of a very local character that occur generally during thunderstorms.

WATER SUPPLY. *See* DAM; RESERVOIR; PLUMBING.

WATERTOWN. A town of Massachusetts, United States, in Middlesex county, on the Charles River; served by the Boston & Maine Railway. Pop. 34,900.

WATERTOWN. A city of Wisconsin, United States, on Rock River; served by the Chicago, Milwaukee, & St. Paul Railway. Settled in 1835, it was chartered as a city in 1853. Pop. 10,613.

WATERTOWN. A city of New York, United States, the county seat of Jefferson county, on the Black River; served by the New York Central & Hudson River Railway. Incorporated in 1816, it became a city in 1869. Pop. (1930), 32,205.

WATER-VIOLET (*Hottonia palustris*). An aquatic herb, order Primulaceæ, not uncommon in ponds and ditches in Britain. It has finely divided leaves, and tall aerial scapes with whorls of pretty lilac flowers. *See* HETEROSTYLY.

WATFORD. A municipal borough of England, in Hertfordshire, on the Colne. It has breweries, corn- and paper-mills, etc. There are chocolate and cocoa factories. The London Orphan Asylum is located there. Pop. (1931), 56,799.

WATH-UPON-DEARNE. Market town and urban district of Yorkshire (W.R.). It is 7 miles S.E. of Barnsley, and 164 miles from London by the L.N.E. Railway. It is on the South Yorkshire coalfield and is served by a canal. Pop. (1931), 13,653.

WATSON, John. Author, better known by his pseudonym of Ian Maclaren, born in 1850, died in 1907. He became a licensed minister of the Free Church of Scotland in 1874, and after short periods of ministerial service at Logiealmond and Glasgow he was chosen in 1880 minister of Sefton Park Presbyterian Church, Liverpool. He resigned this charge in 1905. He published under the pseudonym of Ian Maclaren successful stories and sketches of Scottish life, especially *Beside the Bonny Brier Bush* (1894).

WATSON, Sir William. English poet, born in 1858. His first volume, *The Prince's Guest and other Poems*, was published in 1880. Four years later he issued his *Epigrams of Art, Life, and Nature*, but it was not till the publication of *Wordsworth's Grave and other Poems* (1890) that he gained adequate recognition from the public. His later volumes include: *Lachrymæ Musarum and other Poems* (1892),

The Eloping Angels (1893), *The Hope of the World and other Poems* (1898), *For England* (1903), *The Man who Saw* (1917), and *The Superhuman Antagonists* (1919). He was knighted in 1917, and a national presentation was made to him in 1930.

WATT, JAMES. The most celebrated of British mechanical engineers; born at Greenock in 1736, died at his seat at Heathfield, Staffordshire, in 1819. His father was a merchant and magistrate of Greenock, and young Watt received a good education there. Having determined to adopt the trade of mathematical instrument maker, he went to London (1754) for instruction, but ill-health compelled him to return after a year's apprenticeship.

Shortly afterwards he endeavoured to establish himself in Glasgow, was appointed in 1757 mathematical instrument maker to the university, and resided within its walls till 1763. From this time till 1774 he acted as a civil engineer, and made surveys for canals and harbours, some of his plans being afterwards carried out. It was during this period that he gave shape to his chief improvements on the steam-engine (*see* STEAM-ENGINES). In order to produce the improved machine, he associated himself (1775) in business with Matthew Boulton, the firm of Boulton & Watt having their engine-works at Soho, Birmingham. He retired from business in 1800.

Watt was a Fellow of the Royal Societies of London and Edinburgh, and member of the National Institute of France. He was twice married, and was survived by one son, who carried on the establishment at Soho in partnership with a son of Boulton. Besides improving the steam-engine, Watt invented or improved a variety of mechanical appliances, including a letter-copying press. He was a man of high mental power generally, and possessed a wide and varied knowledge of literature and science. A monument by Chantrey was erected to his memory in Westminster Abbey.

WATT. The practical unit of electric power. It is represented by a current of 1 ampere flowing through a circuit whose potential difference is 1 volt, or any current in amperes obtained with a potential difference of its reciprocal in volts. The watt is too small a unit for general use, and is replaced by one a thousand times greater, known as the kilowatt. The number of watts equivalent to 1 h.p. is 746, and consequently a kilowatt is equal to 1·34 h.p. By combination of the power with the time during which it operates, the unit of electrical energy, or kilowatt hour, which is also known as the Board of Trade unit, is obtained.

WATTEAU (vât-ō), **Jean Antoine.** French painter, born at Valenciennes in 1684, died at Nogent-sur-Marne in 1721. He first worked under Gérin at Valenciennes, where he had the opportunity of studying Rubens and Van Dyck. In 1702 he went to Paris and engaged in decorative work, coming into touch with Claude Gillot and Audran, the keeper of the Luxembourg, where he was able to study Rubens, Titian, and Veronese. His talent once recognised, he rapidly became popular and prosperous.

His earliest pictures were mainly of camp and genre scenes, but later he turned to the painting of *fêtes galantes*, that is, pleasure parties, balls, masquerades, and similar subjects, typified by the brilliant *Embarkation for Cythera* (Louvre), the picture painted on his reception into the Academy (1717). Founder of the brilliant Rococo school of eighteenth-century France, Watteau was unequalled by his followers in poetic imaginative power, subtlety of perception, and exquisiteness of handling. The Wallace Collection possesses an unrivalled group of his paintings.

WATTLE-BIRD. An Australian bird (*Anthochæra carunculata*) belonging to the honey-eaters, and so named from the large reddish wattles on its neck. It is about the size of a magpie, and is of bold, active habits.

WATTMETER. An instrument for measuring electrical power. In direct-current working the simple multiplication of the voltage and amperes passing gives the watts in use; but such is not always the case with alternating currents, whose current and pressure may be out of phase (*see* INDUCTANCE). The majority of wattmeters have a fixed and a moving coil. One of these is of high resistance, and is connected up as the voltage winding; while the other is of low resistance, and conveys the current or a certain shunted proportion of it. The power is proportional to the torque produced on either coil. The instrument is made direct-reading by having the moving coil provided with an index or needle, and arranged to act against the action of a spring. An instrument of that type may be used for either direct or alternating currents.

The most important commercial electrical measurement is the metering of supply to consumers, which is done by watt-hour meters of the integrating type, or, in the case of a direct-current system, sometimes with ampere-hour meters, which are calibrated, by

allowing for the supply pressure. in kilowatt-hour or Board of Trade units.

WATTS, George Frederick. English artist, born 1817, died 1904. He first exhibited at the Royal Academy in 1837. In 1843 and 1847 he secured prizes of £300 and £500 from the Commissioners for the Decoration of the Houses of Parliament for his *Caractacus* and *Alfred inciting the Saxons to attack the Danes at Sea*; afterwards painting *St. George and the Dragon* for the Parliament Houses, and *The School of Legislation* for Lincoln's Inn. Among his more important pictures are: *Life's Illusion* (1849); *Sir Galahad* (1862); *Ariadne* (1863); *Esau* (1865); *Love and Death* (1877); *Time, Death, and Judgment* (1878); *Happy Warrior* (1884); *Hope* (1886); *Judgment of Paris* (1887); *The Angel of Death* (1888); and *Court of Death* (1902). He was a great idealist, and a subtle and powerful portrait-painter. He presented many of his works to the nation. Watts was also a sculptor of mark.

WATTS, Isaac. English theologian and hymn-writer, born 1674, died 1748. In 1702 he became minister of a Dissenting congregation in London, but ill-health compelled him in 1712 to relinquish his pastoral duties, and henceforth he resided at the house of Sir T. Abney, a London alderman, at Newington. His theological works are all forgotten, but his hymns are among the best in English. *See* HYMNS AND HYMN-WRITERS.

WATTS-DUNTON, Theodore. English poet, born in 1832, died in 1914. His long connection with the *Athenæum* began in 1875. In 1897 he collected in *The Coming of Love and other Poems* some of the more important of his poetical contributions to the *Athenæum* and other periodicals. *Aylwin*, a novel or romance published in 1898, forms a striking prose counterpart to *The Coming of Love*, and shows intimate knowledge of gipsy life. He is chiefly remembered, however, on account of his friendship with Swinburne, who shared his home for almost thirty years, until his death in 1909.

WAVE. The essential features of wave motion are seen in the familiar example of plane surface waves in water. Any particle oscillates about its mean position in a certain *period* T, or with a certain *frequency* f (*see* SOUND). In each period the crests of the waves advance through the *wave-length* λ, at a constant speed or *wave-velocity* V. It follows that $\lambda = VT$, and $\lambda f = V$. The height of a surface particle above the mean level is a function of $x - Vt$, where x represents the co-ordinate distance from a fixed origin, and t is the time; for the height at (x, t) must be reproduced at $(x + Vt_1, t + t_1)$, since the wave travels a distance Vt_1 in time t_1. Similarly, when the condition of any medium at (x, t) depends only on the value of $x - Vt$, a plane wave is said to be travelling through the medium in the x-direction with velocity V. In the most important class of cases the conditions are periodic, so that the medium is in the same state in every respect at time $t + T$ as at time t, if T is the period. (No natural motion is strictly of this type, owing to the presence of energy-dissipating forces; these can usually be allowed for by the introduction of a damping factor, say $e^{-\alpha t}$, into the expressions for the disturbance.) Among periodic disturbances the simplest are those of *sinusoidal* type, in which the dependent variable y is given by an equation of the form $y = A \sin n(x - Vt)$. Here y and its derivatives remain unchanged if x is increased by $2\pi/n$, or t by $2\pi/nV$; the wave-length λ is therefore $2\pi/n$, and the period T is $2\pi/nV$, i.e. λ/V.

For surface waves in water, it can be shown that $V^2 = (g\lambda/2\pi) \tanh (2\pi h/\lambda)$, where g is the acceleration due to gravity, and h is the mean depth. This gives, for deep-sea waves, $V^2 = g\lambda/2\pi$; and for long waves in shallow water $V^2 = gh$. The orbit of any particle of the water is an ellipse. For very short waves, the influence of surface tension (*see* CAPILLARITY) becomes appreciable. In this case $V^2 = g\lambda/2\pi + 2\pi T/\lambda\rho$, where T is the surface tension and ρ the density. V is least when the wave-length is $2\pi\sqrt{(T/g\rho)}$. For waves of length less than this, surface tension is more important than gravity; Lord Kelvin called such waves *ripples*.

In an isotropic elastic solid (*see* ELASTICITY) a disturbance originating at an internal point is propagated in waves of two distinct types: (1) waves of compression and dilatation, with velocity $\sqrt{(k + \frac{4}{3}\mu)/\rho}$ (*see* STRENGTH OF MATERIALS); (2) distortional waves, with velocity $\sqrt{\mu/\rho}$; ρ being the density. In a cylindrical rod, three main types of waves are possible—longitudinal, torsional, and flexural. Such waves are intimately related to the *free vibrations* of the solid. The nature of the relation may be illustrated by the simple example of a stretched string or wire. If a string lies along the axis of x when at rest, and if the particle at x is displaced transversely to (x, y) at time t, it is easy to prove that $d^2y/dt^2 = V^2 d^2y/dx^2$, where $V^2 = T/\rho$, T being the tension and ρ the mass per unit length. The solution of this equation

is $y = f(x - Vt) + F(x + Vt)$, where f and F are arbitrary functions, so that the disturbance consists of two waves travelling in opposite directions with velocity V. As a particular case $y = A \sin m(x - Vt) + A \sin m(x - Vt)$, or $y = 2A \sin mx \cos mVt$, which represents a simple harmonic vibration (*see* FOURIER SERIES) or, as it is frequently called, a *standing wave*. For an arithmetical method of resolving *any* vibration into its simple harmonic constituents, see G. A. Gibson, *Introduction to the Calculus*. *See* SOUND; LIGHT; ETHER; WAVE THEORY OF LIGHT; WIRELESS TELEGRAPHY; INTERFERENCE; HARMONIC MOTION; HARMONICS.—BIBLIOGRAPHY: H. Lamb, *Hydrodynamics*; Lord Rayleigh, *Sound*.

WAVE MECHANICS. A development of quantum theory (q.v.) initiated about 1926 by L. de Broglie, and carried further by Schrödinger, Heisenberg, and Dirac. The general idea is that the motion of particles involves wave motion.

WAVE THEORY OF LIGHT. A wave theory of light was first promulgated by Christiaan Huygens (q.v.) about 1690. It was unable, however, to explain the rectilinear propagation of light in a satisfactory manner, and consequently was not received favourably. For more than a century the field was held by Newton's emission theory, according to which a ray consisted of a jet of small particles. But in 1802 Young discovered the principle of *interference* (q.v.) and greatly improved the wave theory, and in a classic series of memoirs dating from 1816 Fresnel treated the whole field of light from the standpoint of the wave theory in such an effective manner that it found universal acceptance. Fresnel showed that the light waves were transverse, he investigated the properties of the *ether* (q.v.) in which they travelled, and he derived numerical formulæ for the losses at reflection, velocity in a crystal, etc., which have stood the test of the subsequent century in a very satisfactory manner.

According to Fresnel, the ether was a solid body and the light vibrations were analogous to the vibrations of material particles. Various mathematicians attempted to make the matter more precise without much success, until Clerk Maxwell introduced his electromagnetic theory about 1865. According to this theory we are to think of the light wave as a wave of electric force combined with a wave of magnetic force, these forces being at right angles to one another and to the direction of propagation of the wave.

Clerk Maxwell's theory is base his equations of the electromagn field, which play pretty much same rôle in light and electricit Newton's law of gravitation doe astronomy. They cannot be simply; the one set is a generalisa of the expression for the magn force in the field of a wire carryin current (Oersted's experiment), the other is a generalisation of laws of current induction investig by Faraday. Maxwell's theory neglected until 1887-8, when H demonstrated in the laboratory existence of electromagnetic wa of much greater wave-length t light waves; then it was recei with enthusiasm.

Maxwell thought of all media continuous. Towards the end of l century the view was developed t the atom consisted of electrons, sm electrically charged particles, wh under certain circumstances emit light waves, and which oscillat under the influence of the light wa when the latter passed over the This was a continuation of the stea development which had taken pla from the time of Fresnel. B presently a difficulty arose. If a r of carbon is heated, it glows fi with a dark heat, then becomes re hot, orange, and finally white. Carb approximates to what is known the theoretical "black body," a bod which would absorb all the ligh falling on it and reflect none, and t change in the character of the radi tion of the black body with temper ture and wave-length has been t subject of much study.

In a mathematical investigation the matter Planck found it necessar to assume that light was emitted b the electrons not continuously but i definite quantities or quanta, as h called them, at a time. Each wave length had its own quantum, the valu of the latter being given by $h\nu$, wher h is a constant known as Planck' constant and equal to $6{\cdot}55 + 10^{-2}$ erg sec., and ν is the frequency of a light wave, i.e. the number of crest that pass per second.

Colour of Light	Wave-length	Frequency	Quantum
	cm.		erg
Red ..	0·0000650	$4{\cdot}62 \times 10^{14}$	$3{\cdot}02 \times 10^{-12}$
Green ..	0·0000523	$5{\cdot}71 \times 10^{14}$	$3{\cdot}74 \times 10^{-12}$
Violet ..	0·0000450	$6{\cdot}66 \times 10^{14}$	$4{\cdot}36 \times 10^{-12}$

The above table gives the value of the quantum worked out for three wavelengths in the visible spectrum.

The quantum has also cropped up in other fields. In the production of

ys, for example, it is found that
ı the electron in the stream of
ode rays has a quantity of kinetic
gy $\frac{1}{2}mv^2$, the maximum frequency
ıe X-ray generated is given by
'elation $\frac{1}{2}mv^2 = h\nu$, and when this
ıy falls on a metal, it may eject
her electron which will have a
imum energy equal to the energy
the initial cathode ray. The
ıode ray transfers a quantum to
X-ray, and the latter apparently
ısfers the same quantum whole
undivided to another electron.
v a wave spreads out on all sides
n its source and delivers its
rgy in all directions. If the X-
s spread out by wave motion in all
ections, they obviously cannot de-
:r all their energy to one electron.
nce it has been suggested that
rays and consequently light cannot
propagated by ordinary wave
ıtion, but by something analogous
Newton's emission with quantities
energy substituted for Newton's
rticles. Such speculations pass
ıder the name of "quantum theory
light"; they have never been
rmulated precisely, and they have
und their vogue among chemists
ıd investigators of radio-activity
ther than with students of light.
hey have received wide publicity in
ıe popular scientific press.

The view generally held is that the
ave theory is not in need of radical
lteration, and that the quantum is
quantity of energy released or ab-
orbed by some internal change in
he atom. Larmor has compared it
vith the energy stored in a compressed
pring which is fed by an escapement
nto a pendulum. The pendulum, like
.he electron, radiates continuously,
ut if the spring is fully wound and
allowed to run down, energy is always
delivered up in the same definite
quantities. While little progress has
been made towards the elucidation of
the quantum itself, a school of phy-
sicists has taken it for granted and
used it to develop a theory of spectra;
work in this field is very active at
present.

The ordinary wave theory permits
of light being propagated in pulses.
White light is now regarded as con-
sisting of pulses which are converted
into regular harmonic trains by falling
on a glass prism; this follows from
the work of Gouy and Rayleigh. Such
pulses show the phenomena of inter-
ference and diffraction. But they
spread out equally in all directions,
and so do not meet the requirements
of the quantum theorists. And the
latter have found it quite impossible
to explain interference, diffraction,
polarisation, etc., from their stand
point. *See* QUANTUM THEORY.—

BIBLIOGRAPHY: R. A. Houstoun, *Treatise on Light*; E. T. Whittaker, *History of the Theories of Aether and Electricity*.

WAVRE. A town of Belgium, in the province of Brabant, on the Dyle; served by rail to Louvain and Charleroi. The town was occupied by the Germans in Aug., 1914. Pop. 8500.

WAX. The name given to various solid substances of animal or vegetable origin, e.g. bees-wax (q.v.) and paraffin (q.v.) wax. Bees-wax is the melissic ester of palmitic acid, and most waxes are esters of monohydric alcohols, being thus distinguished from oils and fats, which are glycerides. In pharmacy, bees-wax occurs in two forms, the white and the yellow, used chiefly for ointments and plasters respectively. The specific gravity of either form is 0·958 to 0·970, and the melting-point 61° to 64° C. Bees-wax is insoluble in water, slightly soluble in boiling alcohol or ether, and readily soluble in hot oil of turpentine.

WAX-ENGRAVING. A process for producing blocks for printing in the type press, patented and used by Alfred Dawson in 1872 and called by him typographic etching. The drawing is made upon a metal plate coated with wax with a point generally of steel; when completed the blank spaces between the lines have more wax added, causing the plate to have the appearance of a series of hills and valleys. The plate is then black-leaded and hung in an ordinary electrotyping bath, so that copper is deposited upon the surface. The copper shell so made receives a backing of lead, which after turning and planing is mounted upon a wood or metal block, making with the mount exactly the height of type.

WAX-WING (*Ampĕlis garrŭlus*). A perching bird of the family Ampelidæ. It derives its name from the appendages attached to the secondary and tertiary quill-feathers of the wings, which have the appearance of red sealing-wax.

WAZIRISTAN. A district of the North-West Frontier Province of India, situated in the south-west of that province on the mountainous Afghanistan frontier; area, *c.* 5000 sq. miles. The British agent has his headquarters at Miram Shah. The inhabitants of Waziristan (especially the Mahsuds) have caused the British considerable trouble, and there was great unrest in the district in 1921.

WEALD. A valley or tract of country lying between the North and South Downs of Kent and Sussex in England.

WEALDEN BEDS. The lowest division of the Cretaceous system in south-eastern England, including the Hastings Sand and the Weald Clay, both of freshwater origin. The lake in which they were formed extended into the Boulonnais area of France, and similar conditions prevailed in Belgium, while the typical marine Neocomian strata were accumulating farther to the south-east. *See* CRETACEOUS SYSTEM.

WEALDSTONE. Urban district of Middlesex. It is 11 miles from London, on the L.M.S. Railway, and is a residential district. Pop. (1931), 27,001.

WEALTH. Most economists have tried to define wealth, but it is a vague term, and it does not much matter what precise meaning we give to it as long as, for the purposes of any discussion, we adhere to one. Professor Marshall says: "All wealth consists of things that satisfy wants, directly or indirectly. All wealth consists of desirable things, or things that satisfy human wants; but not all desirable things are reckoned as wealth. The affection of friends, for instance, is an important element in well-being, but it is not reckoned as wealth, except by poetic licence."

It is customary to use the word in a somewhat different sense when we speak of national wealth on the one hand, and the wealth of an individual on the other. A man's wealth may generally be taken to be his stock of material goods to which he has private property rights, and which he can therefore sell or exchange. These will include not only tangible objects, such as land, houses, furniture, and machinery, but also stocks and shares, and other claims which he may have upon his fellow-men. In addition to these things, the wealth of an individual will include his business and professional connections—"goodwill," and immaterial advantages of that kind; but it is not convenient, as a rule, to include personal qualifications and faculties as wealth, even though these may be productive of wealth, because they are not directly transferable and exchangeable.

When we speak of the wealth of nations, however, we shall have to give a wider interpretation to the term. The national wealth must include that of all the individuals composing it, but, in addition to these, there are collective goods which may make all the difference to the wealth or poverty of the community as a whole. Thus there are in any civilised country roads and canals, public buildings and parks, and other national property of a valuable kind, and more important even than these are those "free gifts of nature"—the rivers, climate, natural fertility of the soil, etc.—which fundamentally determine the general level of well-being among the inhabitants. It will be obvious, moreover, that although individual faculties and capabilities may be conveniently excluded from the computation of individual wealth, the sum of these qualities in the citizens of a state is a most important factor in the wealth of the state as a whole.

WEASEL (*Putorius vulgāris*). A digitigrade carnivorous mammal, family Mustelidæ, a native of almost all the temperate and cold parts of the northern hemisphere, and one of the best-known British quadrupeds.

Weasel

It measures about 2½ inches in height, and 7½ inches in length, with a tail about 2½ inches long. The body is extremely slender, the head small and flattened, the neck long, and the legs short. It feeds on mice, rats, moles, and small birds, and is often useful as a destroyer of vermin in ricks, barns, and granaries. The polecat, ferret, ermine, and sable are akin.

WEAVER-BIRD. A name given to birds of various genera, belonging to the Ploceidæ and related to the finches. They are so called from the remarkable structure of their nests, which are woven of various vegetable substances. Some species build their nests separate and singly, and hang them from slender branches of trees and shrubs; but others build in companies, numerous nests suspended from the branches of a tree being under one roof, though each one forms a separate compartment and has a separate entrance. They are natives of the warmer parts of Asia, of Africa, and of Australia. The *Ploceus icterocephălus*, or yellow-crowned weaver, is a native of South Africa.

WEAVING. The art of interlacing yarn threads or other filaments by

means of a loom, so as to form a web of cloth or other woven fabric. In this process two sets of threads are employed, which generally traverse the web at right angles to each other. The first set extends from end to end of the web in parallel lines, and is commonly called the *warp*; while the other set of threads crosses and interlaces with the warp from side to side of the web, and is generally called the *weft* or *woof*.

In all forms of weaving the warp threads are first set up in the loom, and then the weft threads are worked into the warp, to and fro, by means of a *shuttle*. It was by this fundamental process of interlacing two sets of threads in looms of simple mechanism that the mummy cloths of Egypt, the fine damasks and tapestries of the Greeks and Romans, the Indian muslins, the shawls of Kashmir, and the famed textile fabrics of Italy and the Netherlands were produced.

Hand-loom. Up to about 1850 practically all weaving was effected by means of the hand-loom. This loom, in its simplest form, consists of a frame of four upright posts braced together by cross-beams, the centre beam at the back being the warp-beam, the beam in front being that upon which the web is wound, while just above this, in front, is the breast-beam over which the woven cloth passes on its way to the cloth-beam. At the top of the loom is an apparatus by which the *heddles* are lifted or lowered by means of connections to the *treadles* under the foot of the weaver. The heddles or *healds* are two frames, between the upper and lower *shafts* of which strings or wires are extended. On each string an eye, or *mail*, is fitted, through which one of the warp threads passes. As these threads are controlled by the frames, alternately, it follows that when one heddle is raised, every second thread in the warp is also raised, while the remaining threads are depressed; and this is called *shedding the warp*. When the warp-threads are thus parted, there is left a small opening or shed between the threads, and it is through this opening that the weaver drives his shuttle from side to side. The shuttle, which is hollow in the middle, contains the weft-thread wound round a bobbin or pirn, or else in the form of a cop on a shuttle tongue, and as the shuttle is shot across the web this weft-thread is drawn from the pirn, bobbin, or cop. When the thread is thus introduced, it is necessary to bring it to its place in the fabric. This is accomplished by means of the reed which is held securely in the *lay* or *batten*; the latter is suspended from the top of the loom, and works to and fro like a pendulum by an attachment of vertical rods at each side called the swords. The reed itself is formed of a number of steel or wire uprights, flattened and fixed in the top and bottom boards. A usual method is to insert two warp-threads in each opening (split or dent) of the reed, although this number is often varied for special purposes. The shuttle was originally thrown across by hand, first with the left and then with the right if the fabric was a narrow one; two weavers would be required for a wide cloth.

A great improvement was made upon the hand-loom when John Kay, about 1740, invented the fly-shuttle, as it was called. This enabled the weaver to drive the shuttle both ways with the right hand by means of a cord and picker attached to a box spindle near each end of the shuttle-race, which impelled the shuttle to and fro at each jerk of the cord.

Jacquard Loom. For figured fabrics, the draw-loom was used, but Joseph Marie Jacquard's invention of the cylinder, which he used in conjunction with parts invented by Falcon and Vaucanson, perfected the loom which now bears his name. This loom is an ingenious arrangement of hooks, wires and cords, by means of which the warp-threads are lifted in any order and to any extent necessary to make the shedding required by the pattern. The order in which these hooks are successively lifted and lowered is determined by means of a series of pasteboard cards punctured with holes, the holes and blanks corresponding to a certain pattern and the cards passing successively over a cylinder or drum. The needle wires pass through these holes and cause the hooks to be left in position for being lifted, while those pressed back by the needle wires remain down. In this way the raised hooks lift the warp-threads in an order which secures that the arranged pattern is woven into the fabric. When the pattern is extensive, the machine may be provided with as many as 1000 hooks and wires, or even more.

Power-loom. Another development was made in the art of weaving by the invention of the power-loom by the Rev. E. Cartwright in 1784. In the power-loom, which has been gradually improved and adapted to water, steam, gas, and electric power, the principal motions of the old method of weaving, such as shedding the warp-threads, throwing the shuttle, and beating up the thread, are still retained. The frame of the power-loom is of cast iron, and motion is communicated to the loom by means of a crank-shaft, the stroke of the lay

being made by cranks attached to the driving shaft, while the shuttle is driven across alternately, in general, from side to side, but in various other ways if desired, by a system of cams, levers, picking arms, and connections to the pickers in the box spindle.

Although the principle of the loom is more or less the same in all kinds of weaving, yet there are numberless modifications for the production of special fabrics. The lappet loom is one suitable for weaving small effects, resembling embroidery, on a plain cloth or on a gauze cloth. The latter cloth is obtained by a scheme of cross-weaving, in which one set of threads is made to cross from side to side of another set, and held in these crossed positions by the weft. *See* CARPET ; VELVET.

WEBB, Sir Aston. English architect. He was born in London, 22nd May, 1849, and soon came to the front in his profession. He designed the Victoria Memorial, the Admiralty Arch, and the new front of Buckingham Palace. He also restored the Church of St. Bartholomew the Great. He became R.A. in 1903, was knighted in 1904, was appointed K.C.V.O. 1914, G.C.V.O. 1925, and from 1919 to 1924 was President of the Royal Academy. He died 1st Aug., 1930.

WEBB, Beatrice. *See* PASSFIELD, LADY.

WEBB, Mary. British novelist, born in Shropshire, the daughter of a schoolmaster. She wrote poetry before she took to novel writing. In 1912 she married H. B. L. Webb, a schoolmaster.

After her death in 1927, Mr. Baldwin, the Premier, drew attention to her novels of Shropshire life which immediately became famous. Her works include *Precious Bane*, *Gone to Earth*, *The Golden Arrow*.

WEBB, Sidney. *See* PASSFIELD, LORD.

WEBER (vā'bĕr), **Karl Maria Friedrich Ernst von.** German musical composer, born 1786, died 1826. In 1800 he wrote the opera *Waldmädchen* (Wood-maiden), and had it performed at Chemnitz and Freiberg, in Saxony. In 1803 he visited Vienna, where he became acquainted with Haydn and the Abbé Vogler, from whom he received great help in his studies. From 1813 to 1816 he was director of the opera at Prague. At the close of 1816 he settled at Dresden, where he was founder and director of the German opera.

In 1820 he went to Berlin to bring out *Der Freischütz*, the most celebrated of his compositions. It was performed in London and Paris two years later. In 1822 *Euryanthe* was produced on commission for Vienna, and was brought out there in Aug., 1823. In 1826 Weber visited London to superintend the production of *Oberon*, which he had composed for Covent Garden Theatre. It was enthusiastically received. Besides the operas mentioned, Weber wrote a large number of other works.—Cf. Sir Julius Benedict, *Weber*.

WEBER, Wilhelm Eduard. German physicist, born 1804, died 1891. For most of his life he was professor of physics at Göttingen. Weber played a prominent part in the earlier development of electrical science on the theoretical as well as on the practical side, and did a great deal to establish the system of absolute electrical units. The name *Weber* is sometimes used for the practical unit of magnetic flux, or 10^8 C.G.S. units.

WEBSTER, Daniel. American statesman, born in 1782 at Salisbury, in New Hampshire, died in 1852. In 1836 (and again in 1848) he was an unsuccessful candidate for the presidency. In 1841, under the presidency of General Harrison, he was appointed Secretary of State, and he had an important part in the arrangement of the Ashburton Treaty of 1842. He was opposed to the admission of Texas as a slave state and to the Mexican War, but supported Clay's "compromise" of 1850. In 1850 he succeeded General Taylor as Secretary of State for Foreign Affairs under President Fillmore. A collection of his speeches, State papers, and correspondence was published at Boston the year before his death.—Cf. G. T. Curtis, *Life of Daniel Webster*.

WEBSTER, John. English dramatist, was writing plays between 1602 and 1624. To write a biographical notice of Webster is as easy as it is to write on the ophiology of Iceland. Apart from the uninspiring fact that he was a tailor, we know nothing of his life. We do not know when he was born or when he died.

Collaborations. During his apprenticeship as a dramatist he wrote only in collaboration. He collaborated with Middleton and others in two plays, *Cæsar's Fall* and *The Two Harpies*, and assisted Dekker, Heywood, and Wentworth Smith to write *Lady Jane*. The former two plays are lost ; but *Lady Jane* is usually identified with *The Famous History of Sir Thomas Wyat*, an invertebrate play which bears many traces of the hand of Dekker and none of the hand of Webster.

Webster had some share in the second edition of Marston's *Malcon-*

nt (1604), but it is probable that his le contribution was the induction, work of little merit. The two tizen comedies *West-Ward Hoe!* and *orth-Ward Hoe!* were both written in onjunction with Dekker. The former robably induced Jonson, Chapman, nd Marston to write *Eastward Hoe!* 605), which in its turn prompted he production of *North-Ward Hoe!* hese plays were written in friendly valry, not in enmity; and Dekker's nd Webster's two plays are good and igorous, though not equal to *East-ard Hoe!*

Masterpieces. There is much evi-ence to show that Webster was a areful and deliberate workman; col-aboration, therefore, did not suit im, and he reserved his strength for is original work. During the next eriod of his work Webster wrote his two great tragic masterpieces, of which the earlier is *The White Divel* (also known as *Vittoria Corombona*). This play was printed in 1612, and was probably written in the previous year. The source of its plot has caused some investigators considerable trouble. The play is founded on fact, and the events on which it is based took place between 1581 and 1585. No account of these events has been found which corresponds exactly with the version given by Webster. It is probable that the alterations which Webster introduced were for the purpose of making the play more effective on the stage, just as Shakespeare altered Cinthio when writing *Othello*. Webster's object was to make a powerful tragedy, not to satisfy meticulous historians. He has completely attained his object. This play is masterly. It is a sublimation of the tragedy of revenge as written by Kyd and, at a later date, by Tourneur.

The other masterpiece of Webster, *The Dutchesse of Malfy*, is, if anything, more masterly. It is based on an old story, which is probably alluded to by Malvolio in *Twelfth Night*, II., v., 45 ("the lady of the Strachy married the yeoman of the wardrobe"). This play was probably written about 1613, though not printed until 1623. It is a riper play than its great predecessor, and is probably the greatest non-Shakespearean tragedy of Elizabethan times. In these two plays Webster shows himself to have complete mastery over all forms of pity and terror, and to be able to raise melodrama to the plane of tragedy.

Webster's other plays include: *The Guise* and *A Late Murther of the Sonne upon the Mother* (with Ford), both lost; *The Devil's Law-case*, an unequal play in which purple patches are sewn on some veritable fustian; *Appius and Virginia*, a play which is meritorious rather than masterly; and *A Cure for a Cuckold*, a mixture of rough farce and romantic comedy. He has also been credited or debited with the authorship of *The Thracian Wonder*, a play in which he had no share. The usual elegy on Henry, Prince of Wales, a few occasional poems, and a city-pageant, *Monuments of Honor* (1624), comprise the rest of Webster's extant works.

Appreciation. Webster's fame rests almost entirely on his two masterpieces. In them he has shown himself to be nearest to Shakespeare among the Elizabethans, and, as Domitius Afer said of Virgil, he is "propior primo quam tertio." His work shares with that of Shakespeare the quality of inevitableness; the characters of other playwrights *might* have spoken as they do; those of Shakespeare and Webster *must* so have spoken. Webster is an apt pupil of Shakespeare's; not in the letter which killeth, but in the spirit which giveth life.—BIBLIOGRAPHY: A. C. Swinburne, *The Age of Shakespeare*; R. C. Brooke, *John Webster and the Elizabethan Drama*; E. E. Stoll, *John Webster: the Periods of his Work*.

WEDGWOOD, Josiah. British potter, born at Burslem, in Staffordshire in 1730, died in 1795. He received little education, and went to work in his brother's factory at the age of eleven. He removed for a time to Stoke, where he entered into partnership with persons in his own trade, and where his talent for ornamental pottery was first displayed. Returning in 1759 to Burslem, he set up a small manufactory of his own, in which he made a variety of fancy articles. His business improving, he turned his attention to white stoneware, and to the cream-coloured ware for which he became celebrated. His reproduction of the Portland Vase is famous. His improvements in pottery created the great trade of the Staffordshire potteries.

WEDGWOOD WARE. A superior kind of semi-vitrified pottery, without much superficial glaze, and capable of taking on the most brilliant and delicate colours produced by fused metallic oxides and ochres; so named after the inventor. It is much used for ornamental ware, as vases, etc., and, owing to its hardness and property of resisting the action of all corrosive substances, for mortars in the laboratory (see illus. p. 510).

WEDMORE. Village of Somerset. It is 4 miles south of Cheddar and gave its name to the treaty made here in 878 between King Alfred and Guthrum the Dane, after the Battle

of Ethandune, according to which the Danes obtained possession of the country north of Watling Street. Pop. (1931), 2385.

WEDNESBURY. A municipal borough of Staffordshire, England, in the Black Country, an important seat of wrought-iron and steel manufactures of the most varied kinds, also stoneware and pottery. It has an ancient church, town-hall, art gallery, free library, etc. Pop. (1931), 31,534.

WEDNESDAY. The name of the fourth day of the week (in Lat. *dies Mercurii*, day of Mercury), derived from the old Scandinavian deity Odin or Woden.

Wedgwood ware

WEDNESFIELD. Urban district of Staffordshire. It is 2 miles N.E. of Wolverhampton and 126 from London, by the L.M.S. Railway. The inhabitants are chiefly engaged in the manufacture of hardware. Pop. (1931), 9333.

WEEDON. Village of Northamptonshire. It is 8 miles from Northampton on the L.M.S. Railway. Here are the buildings of the army School of Equitation. Pop. (1931), 2020.

WEEK. A period of seven days, one of the common divisions of time, the origin of which is doubtful. Among the nations who adopted the week as a division of time, the Chinese, Hindus, Egyptians, Chaldæans, Jews, Persians, and Peruvians have been mentioned, but in some cases the antiquity of the practice is doubtful, and in others the name has been applied to other cycles than that of seven days. The nations wi whom the weekly cycle has be traced with certainty to the greate antiquity are the Egyptians and t Hebrews. With the former we on know of its existence, but with t latter it had a much more importa character. The use of the week w introduced into the Roman Empi about the first or second century the Christian era from Egypt, an had been recognised independently Christianity before the Emperor Co stantine confirmed it by enjoining th observance of the Christian Sabbath With the Mahommedans the week ha also a religious character, Frida being observed by them as a Sabbath

WEETSLADE. Urban district o Northumberland. A colliery centre it is 5 miles from Newcastle-on-Tyne Pop. (1931), 7736.

WEEVER. A name of several spiny-finned fishes of the genus Trachīnus, family Trachinidæ. Two species are found in the British seas, viz. the dragon-weever, sea-cat, or sting-bull, *T. draco*, about 10 or 12 inches long, and the lesser weever, *T. vipĕra*, called also the adder-pike, or sting-fish, which attains a length of 5 inches. They inflict wounds with the spines of their first dorsal fin, which are much dreaded.

WEEVIL. The name applied to small beetles of the family Curculionidæ, distinguished by the prolongation of the head, so as to form a sort of snout or proboscis. Many of the weevils are dangerous enemies to the agriculturist, destroying grain, fruit, flowers, leaves, and stems. The larva of the corn-weevil (*Calandra granaria*) is very destructive to grain, that of the pea-weevil (*Bruchus pisi*) to peas. The name is also incorrectly given to the little biscuit beetle (*Anobium paniceum*), family Ptinidæ.

WEIERSTRASS, Karl. German mathematician, born 1815, died 1897. He was professor of mathematics in Berlin from 1864, and through his lectures there exercised an extraordinary influence on the development of modern mathematics. The characteristics of his work are the rejection of geometrical intuition as a proper basis for analysis, and the foundation of the science on the principles of pure arithmetic. His achievements in this field, and his discoveries in many branches of analysis, more especially in the calculus of variations, elliptic functions, and function theory generally, mark him out as one of the greatest of mathematicians.

WEIGHT. *See* GRAVITY; DYNAMICS.

WEIGHTS AND MEASURES. The chief British units of length, volume, weight, and time are discussed in the articles FOOT, INCH, YARD, CHAIN, MILE; BUSHEL, GALLON; AVOIRDUPOIS, TROY WEIGHT, POUND, TON; DAY, WEEK, MONTH, YEAR. For physical units see DYNAMICS, FOOT-POUND, HORSE-POWER, WORK, DENSITY, AMPERE, FARAD, OHM, VOLT, WATT, INDUCTANCE. A unit of heat has been introduced called the therm; it is equivalent to 10,000 British Thermal Units (*see* CALORIMETRY).

In the *metric system* the standard units are: the *metre* = 39·37 inches, or $1\frac{3}{8}$ yards, nearly; the *gramme* = 15·433 grains; and the *litre* = 61·022 cubic inches, or 0·880 imperial quart. Larger or smaller units are derived from these by successive multiplications or divisions by 10. Thus, in the series kilometre, hectometre, decametre, metre, decimetre, centimetre, millimetre, each unit is 10 times the following unit. The prefixes are Greek and Latin forms indicating the relationship to the metre. The same prefixes are used with *gramme* and *litre* in the tables of weight and capacity. Thus, roughly, 1 kilogramme = 1000 grammes = 2·2 pounds; and 1 kilometre = 1000 metres = $\frac{5}{8}$ mile. *See* ARE.

WEIHAIWEI. A territory of North China in Shantung. It comprises a maritime zone 10 miles wide on the coast of the Shantung Peninsula and the Island of Liukung as well as all those in the Bay of Weihaiwei; total area 285 sq. miles. Weihaiwei was leased to Great Britain in 1898 as a naval station, and the region east of 121° 40′ E. long., with an area of 1505 sq. miles, came automatically under British protection. There is a coast-line of 72 miles, Pop. 154,416.

As a result of the settlement of the "Shantung Question" by the Washington Conference (q.v.) Britain made arrangements to return Weihaiwei to China, subject to certain conditions. The rendition took place in 1930.

WEIMAR (vī'mär). The capital of Thuringia, Germany, on the Ilm, in a beautiful valley surrounded by hills. Weimar is closely associated with the names of Schiller, Goethe, Herder, and Wieland, the first three of whom are buried there. Pop. (1925), 45,957.

WEINHEIM. A town of Baden, Germany, on the Weischnitz; a junction for Fürth and Lampertheim and the Weinheim-Mannheim railway, on the Frankfurt-am-Main–Heidelberg line. There are leather-works and a machine-shop; a mineral spring and bath. Pop. 15,793.

WEIR, Baron. British engineer, born 12th May, 1877, William Weir entered the family engineering firm in Glasgow. During the European War he held various offices connected with munitions, and in 1918 took office as Secretary of State for Air, holding the post until the following year. He was knighted in 1917 and raised to the peerage in 1918. In 1919 he was chairman of the Advisory Board of Civil Aviation, and in 1932 attended the Imperial Economic Conference at Ottawa as an adviser to the British Government.

WEISMANN, August. German biologist, born in 1834, died in 1914. His first book of note was *Studies in the Theory of Descent* (1875-6). The most important of his subsequent works are: *Essays upon Heredity and Kindred Biological Problems* (1889-92), *Germ Plasm* (1893), *The Omnipotence of Natural Selection* (1893), *Fresh Thoughts on the Question of Heredity* (1895), *On Germinal Selection* (1896), *Lectures on the Theory of Descent* (1902), and *The Evolution Theory* (1904).

Weismann was a strong supporter of the natural selection theory, but he is specially known by his theories on the question of heredity. He explained heredity by the continuity from generation to generation of the so-called germ-plasm, and on this basis denies the possibility of inheriting acquired characters. *See* EVOLUTION; HEREDITY.

WEISSENBURG. A noted spa of Switzerland, in the canton of Bern, in the Lower Simmental; served by the Spiez-Zweisimmen Railway. The mineral spring has a temperature of 80° F.

WEISSENBURG-AM-SAND. A town of Bavaria; served by the Munich-Hof Railway. Silver and gold, lace, and beer are made. There is a mineral spring and bathing establishment. Pop. 36,756.

WEISSENFELS. A town of the Prussian province of Saxony, on the Saale; served by rail to Zeitz, Berlin, and Bebra. Shoe-making is the staple industry. Pop. 36,756.

WELBECK ABBEY. Seat of the Duke of Portland. It is situated 4 miles from Worksop in Nottinghamshire and is one of the most famous properties in the Dukeries, standing in a vast park which is part of the old Sherwood Forest. The existing house is mostly seventeenth century, but it is built on the site of a Premonstratensian abbey of the mid-twelfth century. It came into the possession of the fifth Duke of Portland in 1734.

There are extensive underground rooms and tunnels.

WELDING. The process of joining together metal parts by introducing new metal between them in such a way as to make a complete metallic structure. It is now increasingly applied to steelwork in buildings in place of riveting. The ordinary process of smithing is the primitive form, and one that is largely used with the few materials that are suited to it. For the formation of structures in wrought iron, heating and hammering gives adequate strength in the joints, and the process is one in which an ordinary workman can be trained to excel.

With the more complicated work of modern times, the necessity has arisen for the production of welds cheaply on materials which cannot be smithed. One of the most important processes is the use of an oxygen-acetylene flame for melting down a wire or rod of metal into a pool made by the heating of the parent metal where the junction is to be made. Other gases than acetylene have also occasionally been used along with oxygen, such as hydrogen, coal-gas, and blue water-gas. A flame akin to that of a Bunsen burner is obtained and gives a sufficient temperature for the melting process.

Electricity has also been used for the purpose of welding in many different ways, such as by the arc, or by the heating effect of the passage of current through the metals at their proposed junction. Electric arc welding has had a considerable extension from the period of the European War, when its use was advocated in order to leave the available supplies of acetylene for the purpose of cutting heavy steel plates in the shipyards and engineering-works. The process is one of creating an electric arc between a carbon or a metal rod and the parts which are to be welded together. The carbon process is much used in filling holes in heavy castings. Metallic arc welding can, with care, be performed quite satisfactorily with a bare electrode, as is commonly the case in America, but for the better protection of the molten metal it has been customary in this country, and to a certain extent on the Continent, to cover the electrode with a flux material which melts and forms a slag over the work. The coverings used are blue asbestos in association with an aluminium wire surrounding the metal to be melted down, as in the Quasi Arc process; or mixtures of various metallic salts. Alternating or direct current can be used for the process, which requires a pressure of 60 to 100 volts to start the arc. The current can be restricted to that suited to the work by resistances or by the automatic voltage regulation of the machine to meet the arc requirements. When alternating currents are used regulation is commonly obtained by combinations of transformers with choking coils.

Resistance welding in continuous runs or "spots" has been applied to very thin material, and is much used in drum-making and for other sheet-metal purposes. The alternating current supply is taken to a transformer the secondary circuit of which consists of one or two turns and is completed by the work. Tram rails and heavy castings are frequently welded by the Thermit process, in which iron is produced in the liquid state by heating a mixture of aluminium powder and iron oxide by a special igniter powder.

WELLAND CANAL. The Canadian canal, completed in 1932, which connects Lakes Erie and Ontario. It is 26¾ miles long, 300 feet wide at the top, and has eight locks. Ships drawing 25 feet can pass through it, from above Montreal to Port Arthur, 1215 miles distant.

WELLESLEY, Richard Colley, Viscount and Marquess, and Earl of Mornington. British administrator, eldest son of Garrett, first Earl of Mornington, and eldest brother of the Duke of Wellington, born 1760, died 1842. Educated at Eton, and at University College, Oxford, he took his seat as Earl of Mornington in the Irish House of Peers (1781), and three years after was returned to the British House of Commons.

The appointment of Governor-General of India was conferred upon him in 1797, and he was created Marquess Wellesley (Irish peerage) in 1799. His administration forms an era in the history of the British Indian Empire. He returned to England in 1805, and in 1809 became Foreign Secretary under Perceval. In 1812 he resigned, chiefly because he was in favour of Catholic emancipation. He did not return to office till 1822, when he became Lord-Lieutenant of Ireland. This post he retained till 1827. In the Grey ministry he again (1833) became Lord-Lieutenant of Ireland, but finally retired from public life in 1835.—BIBLIOGRAPHY: W. H. Hutton, *Marquess Wellesley*; *The Wellesley Papers*, by the editor of *The Windham Papers*.

WELLINGBOROUGH. A town of Northamptonshire, on the Nene. It derives its name from the chalybeate springs which formerly were

The principal industries are manufacture of boots and shoes, ing, and the smelting of iron. (1931), 21,221.

ELLINGTON, first Duke of. ur Wellesley or Wesley (he used latter spelling until he was in his ieth year) was the fourth son of first Earl of Mornington, and was on or about 29th April, 1769, educated at Eton, and, at the of eighteen, obtained a commis- as ensign in the 73rd Foot (now 2nd Battalion of the Black Watch). il the outbreak of war with France 1793, he seemed likely to have a er as an "ornamental" soldier, ag aide-de-camp to the Lord-utenant of Ireland and a member the Irish Parliament. In 1794-5 saw service in Flanders, and in 7-8 in India, and gained distinc- n in both campaigns.

The great opportunity of his life ne with the appointment of his other, Lord Mornington (after- rds Marquess Wellesley) to the vernor-Generalship of India in 98, for the elder brother recognised e abilities and trusted the judgment the younger. After the capture of ringapatam, he was made governor the town, and he proved himself a pable military administrator in ysore.

His name first became known to e general public in 1803, when, in ie second Mahratta War, he won, Assaye, the first great battle gained ader his own independent command, ad received the thanks of Parlia- ent. In 1805 he returned to Eng- nd as Major-General Sir Arthur Vellesley, and, after some home ervice, became member of Parlia- ent for Rye and Chief Secretary o the Lord-Lieutenant of Ireland. During his tenure of that office (1807-) he took part in the expedition to Copenhagen in 1807, was again thanked by Parliament, and promoted to the ank of lieutenant-general.

In the following year the British Government determined to send an expedition to drive the French out of Portugal and to co-operate with an anti-French rising in Spain, and the command was given to Wellesley, who landed near Oporto in the summer of 1808, with the intention of relieving Lisbon. At Vimeiro, on 21st Aug., he won the first great success on land which had fallen to British arms in the war, but he was immediately superseded automatically by the arrival of two senior officers, who granted the beaten army an armistice and made the Convention of Cintra for the evacuation of Portugal by the French. All three commanders were recalled to appear before a court of inquiry, and Sir John Moore was left to conduct the campaign.

After the death of Moore and the embarkation of his army at Corunna, Wellesley was sent in command of a new and larger expedition to the Spanish Peninsula, where, from 1809 until 1814, he conducted a brilliant series of military operations, by which he ultimately drove the French out of Spain. The campaign was marked by a series of victories, the most famous of which were Talavera (1809), for which Wellesley was raised to the peerage as Viscount Wellington; the successful defence of the lines of Torres Vedras during the winter of 1810-1; Salamanca (1812), when "40,000 men were beaten in 40 minutes;" Vittoria (1813); and the Pyrenees (1813-4). The early operations were very difficult, and Wellington's military conduct was at times subjected to fierce and ungenerous criticisms at home; but he had the support of the Government, and was created first Earl and then Marquess of Wellington in 1812, a field-marshal in 1813, and Duke of Wellington in 1814.

After Napoleon's escape from Elba in 1815 and his restoration to the throne which he had abdicated in the preceding year, Wellington (who in the interval had been British Ambassador at Paris and a plenipotentiary at the Congress of Vienna) was placed in command of the British army and of some allied forces of Dutch, Belgians, and Germans, which assembled in Belgium to co-operate with the Prussians under Blücher, and also with the Russians and the Austrians when they should arrive. Napoleon resolved to attack before Russian and Austrian troops could reach Belgium, and hoped to be able to defeat Wellington and Blücher separately. Separate actions were fought with the Prussians at Ligny (a French victory) and with the British at Quatre Bras on 16th June, 1815, but in the final and sternly contested battle of Waterloo (18th June), a Prussian force under Blücher came up in time to render valuable assistance to Wellington's troops, which had been engaged for some hours.

After his last and greatest victory, the Duke of Wellington commanded the army of occupation in France until 1818, and took part in the Congress of Aix-la-Chapelle. On his return home he was made Master-General of the Ordnance, with a seat in Lord Liverpool's Cabinet, and he became one of the leaders of the Tory party. While advocating reactionary and repressive measures at home, he

sympathised with Canning's policy of non-intervention in the affairs of Turkey, Italy, and Spain, but disapproved of his recognition of the independence of the South American Republics which revolted from Spain, and of the support given to the Greek cause at Navarino.

In Jan., 1827, he became Commander-in-Chief of the army, but resigned this office and the Master-Generalship of the Ordnance when Canning became Prime Minister in April. On Canning's death in August, he again became Commander-in-Chief, and after the fall of the Goderich Cabinet in Jan., 1828, he became Prime Minister. His Toryism made it impossible for him to work with the followers of Canning, and his ministry became purely Tory, but he was compelled by events to carry a measure (of which he personally disapproved) for the removal of Catholic disabilities. His Government continued to oppose the demand for Parliamentary Reform, and was defeated in Nov., 1830. Wellington continued to be the leading opponent of the Reform Bill, but in the crisis of 1832 he advised the Opposition peers to absent themselves from the House of Lords, and so permitted the Bill to pass. During this period he was violently unpopular, and the windows of Apsley House, his London home, were twice broken by a mob; he kept them closed with iron shutters for the rest of his life.

Except for four months in 1834-5, Wellington never again took political office, but he sat in Peel's second Cabinet (1841-6) as minister without portfolio, and he held the Commandership-in-Chief (which he had resigned on becoming Prime Minister) from 1842 until his death, and showed his aversion to change in military as well as political affairs. He died suddenly on 14th Sept., 1852, at Walmer Castle, his residence as Warden of the Cinque Ports, and was buried in St. Paul's Cathedral. Except during the Reform crisis, Wellington occupied an unexampled position of authority and influence in the country, and the death of the "Iron Duke" was felt to be the passing of a national institution. His private character and disposition was hard and unamiable, and it has been said that "the more one reads of Wellington, the more one respects him and the less one likes him."—BIBLIOGRAPHY: Lord Roberts, *The Rise of Wellington*; Sir Herbert Maxwell, *Life of Wellington*; G. R. Gleig, *Personal Reminiscences of the 1st Duke of Wellington*.

WELLINGTON. A town of England, in Shropshire, with manufactures of farm implements, brass and iron ware, etc. Pop. (1931), 8185.

WELLINGTON. A town of England, in Somerset, with manufactures of woollens. The parish church dates from the fifteenth century, and there is an old almshouse. On the Blackdown Hills, which are near, is a memorial to the Duke of Wellington who took his title from this place. Pop. (1931), 7128.

WELLINGTON. Town in New South Wales. It is on the Macquarie River, 255 miles from Sydney on the north-west main line and is the centre of an agricultural and pastoral district, while copper occurs in the neighbourhood. The Wellington Caves contain interesting fossil remains. Pop. 4600.

WELLINGTON. The capital of New Zealand, situated on Port Nicholson, an inlet of Cook Strait, on the south-west extremity of the provincial district of Wellington, North Island. The city is built on modern lines and has ample electric power. The principal buildings are the Government House, the Houses of Legislature, the Government Buildings, the Supreme Court, University College, and the National Museum. Pop. (1932), 144,800.

The provincial district of Wellington has an area of 10,870 sq. miles. It is subject to earthquakes, but has a mild and equable climate; mean annual temperature at Wellington (142 feet altitude), 55° F. (January, 62·5°; July, 47·5° F.); rainfall, 50·5 inches (fairly equally precipitated all the year round). Pop. (1932), 305,770.

WELLS, Herbert George. British novelist and social thinker, born at Bromley, Kent, 1866. The son of a professional cricketer, he was at first employed in a drapery shop, but was able by means of scholarships he had won, to study science. In 1888 he graduated with honours at London University, and for several years taught biology. In 1893 he turned to journalism and literature, contributing to *Nature* and *The Saturday Review*. His first work, *Select Conversations with an Uncle*, appeared in 1895.

The Stolen Bacillus, published in 1895, was the first of a brilliant and popular series of "scientific" romances of which the best known are *The Invisible Man*, *The Sleeper Awakes*, *The First Men in the Moon*, and *The Food of the Gods*. In these he combines a lively imagination and a vast sense of the wonderful with a convincing narrative style and, in some cases (e.g. *The War in the Air*),

ingularly accurate forecast of re events.

lmost equally popular are his ances of lower middle-class life, hich *Kipps* is the typical example. sociological works include *First Last Things, New Worlds for* , and *The Work, Wealth, and ppiness of Mankind* (1932). His as a reformer is intense, but it s short of fanaticism, and much is work is definitely constructive useful. Constructive also are his ursions into history—*An Outline History* (1920), *Short History of World* (1922), and *Short History Mankind* (1925).

ractically all his literary activities co-ordinated with the life and ryday experience of "the man in street." In a sense Wells is him- the apotheosis of the man in the eet, and his genius the sublimation the average man's practical com- n sense. From this aspect he views problems—political, scientific, and iological—of the day, and to this a large measure he owes his popular peal.

His other works include: *The Time achine* (1895), *Love and Mr. Lewis- m* (1900), *Anticipations* (1901), *ankind in the Making* (1903), *A odern Utopia* (1905,) *Tono-Bungay* 909), *Ann Veronica* (1909), *The istory of Mr. Polly* (1910), *The New achiavelli* (1911), *Marriage* (1912), *r. Britling Sees it Through* (1916), *od the Invisible King* (1917), *Joan d Peter* (1918), *The Undying Fire* 919), *Secret Places of the Heart* 922), *Men Like Gods* (1923), *The orld of William Clissold* (1926), *Ir. Blettsworthy on Rampole Island* 928).

WELLS. A city of England, in omersetshire. United with Bath it ives the title to a bishop's see. It ontains one of the most magnificent athedrals in England, with a central ower 155 feet, and two western owers each 126 feet high; it is famed or its west front, its lady chapel, rypt and curious clock dating from he fourteenth century. The bishop's palace is surrounded by a moat, and the deanery is a fine old house. The Vicar's Close, with a chapel at the top, is picturesque, and in the recreation ground is the bishop's barn of the fifteenth century. Pop. (1931), 4833.

WELLS. Urban district and seaport of Norfolk. It is 23 miles from King's Lynn and 121¾ from London, on the L.N.E. Railway. There is a harbour and a little shipping. Pop. (1931), 2505.

WELSBACH BURNER. When certain salts of the rare earths are heated to a high temperature they become incandescent, giving off a very white light (*see* GAS MANUFACTURE). This was recognised by Welsbach, who made gas-mantles of these materials and heated them with Bunsen burners. Modern mantles are made of cotton, ramie, or artificial silk. An asbestos loop is used to bring the top together and serve as a means of support. After dipping the thread is burned out, and the oxide of theorium produced by heating. The mantle is then shaped and finally dipped in a stiffening solution, such as gun-cotton dissolved in alcohol and acetone.

WELSHPOOL. A municipal borough of Wales (Montgomery district), largest town in Montgomeryshire, on the Severn. It carries on the woollen manufacture, and is an agricultural centre. Pop. (1931), 5637.

WELWITSCHIA (wel-wich'i-a). A remarkable plant growing in Southern Africa in dry regions near the western coast, between lat. 14° and 23° S. It presents a stem or rhizome forming a woody mass rising to a foot at most above the ground, and having a diameter of from 4 to 5 inches to as many feet, this mass bearing the two original cotyledonary leaves, which, when they reach their full development of 6 feet in length or so, become dry and split up into shreds but do not fall off. Every year several short flower-stalks are developed at the base of these leaves, but no other leaves are produced. There seems to be but one species, *W. mirabilis*.

WELWYN. Rural district of Hertfordshire. It is situated 5½ miles from Hatfield, on the L.N.E. Railway, 25 miles from London. The Garden City, planned in 1920, between Welwyn proper and Hatfield, is a progressive community with its own station on the L.N.E. Railway. Welwyn is now a centre of the film industry. Pop. (1931 Garden City), 8585.

WEMBLEY. A town of Middlesex, England, 7 miles north-west of London. It is a residential district, but it is best known for its exhibition grounds and stadium. Here the British Empire Exhibitions were held in 1924 and 1925 and in the stadium, which holds 125,000 people, the finals for the association football cup are played. Pop. (1931), 48,546.

WEMYSS. Parish of Fifeshire, Scotland, which includes the villages of East and West Wemyss, Buckhaven, Methil, and Innerleven. It is on the Firth of Forth. Wemyss Castle, deriving its name from the archaic caves, or weems, in the neighbourhood, was the scene of the first

meeting between Mary Queen of Scots and Darnley. Pop. (1931), 24,530.

WEMYSS BAY. A watering-place of Renfrewshire, Scotland, on the Firth of Clyde. Pop. (1931), 24,530.

WEN. An encysted tumour occurring on the scalp or other parts of the body. They are formed by the accumulation of sebum in a hair follicle, or in the recesses of the sebaceous gland of the hair sac, causing distension of the sac. An encysted tumour, in its commencement, is always exceedingly small, and perfectly indolent; and it is often many years before it attains any great size. The best mode of treatment is complete removal by dissecting the swelling out.

WENDOVER. Market town of Buckinghamshire. It is 35½ miles from London on the L.N.E. Railway. The parish church has been restored, and there are some half-timbered houses. Until 1832 Wendover sent two members to Parliament. Pop. (1931), 2366.

WENDS. The general designation used by Germans for a section of the Slavonic race dwelling in Lusatia, and comprising the Sorbs and the Polabs, dwelling between the Elbe and the Oder. In the sixth century the Wends were a powerful people, and occupied the country from the Elbe and the Saale on the west to the Bober on the east. Cut off from contact with the other Slavs and completely surrounded by Germans, the Wends, numbering about 200,000, are now mostly germanised, and the Lusatian-Wendish speech is rapidly disappearing. There is a Wendish national movement.

WENLOCK. A municipal borough of England, in Shropshire. It comprises Much Wenlock, Broseley, Madeley, Coalbrookdale, etc. It has an agricultural trade, and around are coal- and iron-stone mines. Wenlock Edge is a famous beauty spot. Pop. (1931), 14,152.

WENLOCK SERIES. In geology, the middle division of the Upper Silurian system lying immediately below the Ludlow rocks, and so called from being typically developed on Wenlock Edge.

WERDAU. A town of Saxony, on the Pleisse; served by the Leipzig-Hof Railway. Machines and automobiles are made, and with iron-founding, wool, and cotton dyeing and spinning, form the principal industries. Pop. 22,000.

WERDEN. A town of Rhineland, Germany, on the Ruhr; served by rail to Essen. Wool-spinning, weaving and dyeing, glass-blowing, brewing, and boot and cloth manufacturing are the main employments. Pop. 13,000.

WEREWOLF (from A.S. *wer*, a man and *wolf*, cf. Gr. λυκάνθρωπος; Lat. *versipellis*; Ger. *währwolf*; Fr. *loup-garou*). A man temporarily transformed into a wolf. The idea that such a transformation was possible seems to have been common to all Europe, and still lingers in Brittany, Serbia, and parts of Russia.

Herodotus (*Melpomene*, 105) says that the Neuri are sorcerers, and that each Neurian changes himself once in the year into the form of a wolf, and continues in that form for several days. Ovid, in his *Metamorphoses* (i., 163 *seq.*), tells the story of Lycaon, whom Jupiter transformed into a wolf. Pliny (*Nat. Hist.* viii., 22) relates how on the festival of Jupiter, Lycæus, one of the family of Antæus, was selected by lot, and brought to the brink of the Arcadian lake. He then hung his clothes on an oak and plunged into the water, whereupon he was transformed into a wolf. Nine years after, if he had not tasted human flesh, he was permitted to resume his human shape. Virgil (*Eclogues*, viii., 97) mentions one Mœris, who became a wolf and hid himself in the woods.

In the *Satiricon* of Petronius Arbiter, Niceros, a freedman, tells (§ 61) a realistic story of a werewolf: when the wolf was wounded in the neck, the man was found in bed with a wound in the same place. Apuleius (*Metamorphoses*, ii., 22) says that witches "change their skin and turn themselves at will into sundry kinds of beasts, whereby they deceive the eyes even of the Sun and of very Justice; sometimes they are transformed into birds, sometimes into gods and mice, and sometimes into flies." Bodin says that the Royal Procurator-General once shot a wolf, and that the arrow had stuck in the beast's thigh. A few hours after, the arrow was extracted from the thigh of a man lying wounded in bed. At Vernon, in 1566, witches and warlocks assembled in great numbers in the shape of cats. Some men were attacked by them and wounded several of them; next day a number of wounded women were found in the town.

In the British Isles, since there are no wolves, witches take the shape of hares and cats; but it was not so always. Gervase of Tilbury writes: "Vidimus enim frequenter in Anglia per lunationes homines in lupos mutari; quod hominum genus *gerulphos* Galli nominant, Angli vero

were-vulf dicunt." Richard Verstegan, in his *Restitution of Decayed Intelligence* (1605), says: "The werwolves are certayne sorcerers, who having annoynted their bodies with an oyntment which they make by the instinct of the devill, and putting on a certayne inchaunted girdle, doe not onely unto the view of others seeme as wolves, but to their owne thinking have both the shape and nature of wolves, so long as they weare the said girdle. And they do dispose themselves as very wolves, in wourrying and killing, and most of humane creatures."

Epistemon, in the *Dæmonologie* of King James VI. and I., does not believe in "war woolfes;" for he says: "There hath indeede beene an olde opinion of such like things; for by the *Greekes* they were called λυκάνθρωποι, which signifieth menwolfes: But to tell you simply my opinion in this, if any such thing hath beene, I take it to haue proceeded but of a naturall super-abundance of Melancholy, which as we reade, that it hath made some thinke themselves pitchers, and some horses, and some one kinde of beast or other, so suppose I that it hath so viciat the imagination and memory of some, as *per lucida interualla*, it hath so highly occupied them, that they haue thought themselues very Woolfes indeed at these times: and so haue counterfeited their actions in going on their hands and feete, preassing to deuoure women and barnes, fighting and snatching with all the towne dogges, and in vsing such like other brutish actions, and so to become beasts by a strong apprehension, as Nebuchadnezzar was seuen yeeres." *See* LYCANTHROPY.—Cf. S. Baring-Gould, *A Book of Were-Wolves*.

WERNIGERODE. A town of Prussia, on the Holzemme, at the foot of the northern versant of the Harz Mountains; junction for Nordhausen, on the Heudeber-Harzburg Railway. Sawmilling, dye-stuffs, brewing, and the making of agricultural machinery and photographic material are the chief employments. Pop. 19,636.

WESEL (vā′zl). A river-port in Rhenish Prussia, at the confluence of the Rhine and Lippe, both spanned by bridges, 30 miles N.N.W. of Düsseldorf. Manufactures include soap, wire, and cement. Pop. 24,136.

WESER (vā′zĕr). A river of Germany, formed by the junction of the Fulda and Werra at Münden, flows generally in a north-west direction, and, after a very circuitous course, traverses the city of Bremen, and then falls by a wide mouth, very much encumbered with sand-banks, into the North Sea. Its length, including the Werra, is about 440 miles. The navigation for vessels of large size ceases at Bremerhaven.

WESLEY, Charles. English hymnwriter, younger brother of John Wesley, born at Epworth 1708, died in 1788. Educated at Westminster School, and Christ Church, Oxford, he accompanied his brother to Georgia as an ordained clergyman in 1735-6, but soon after his return to England he became a preacher in the Methodist connection, and materially assisted the success of the movement by his numerous hymns, large collections from which have been frequently published.

WESLEY, John. The founder of Wesleyan Methodism, born at Epworth, Lincolnshire (his father being rector of the parish), 17th June, 1703, died 2nd March, 1791. Educated at the Charterhouse, and at Christ Church, Oxford, he took his degree of B.A. in 1724; was ordained deacon in 1725; became a Fellow of Lincoln College, and lecturer and moderator in classics in 1726; and took priest's orders in 1728. He then gathered together a number of pupils and companions who met regularly for religious purposes, and by so doing acquired the name of Methodists. Among these companions were Hervey, Whitefield, and Law, the author of *A Serious Call to a Devout and Holy Life*.

In 1735 Wesley accepted an invitation from General Oglethorpe to go out to America to preach to the colonists of Georgia. After a stay of two years he returned to England (Feb., 1738), and in the following May an important event took place in his life, namely, his conversion. In June he paid a visit to Herrnhut, the Moravian settlement, returning to England in September. Early in the following year (1739) he began open-air preaching, in which he was closely associated with Whitefield, from whom, however, he soon separated, but without a permanent personal breach.

Having now the sole control of the religious body which adhered to him, he devoted his entire life without intermission to the work of its organisation, in which he showed much practical skill and admirable method. His labours as an itinerant preacher were incessant. He would ride from 40 to 60 miles in a day. He read or wrote during his journeys, and frequently preached four or five times a day. He married in 1750 Mrs. Vazeille, a widow with four children, but the union was unfortunate, and

they finally separated. He held strongly to the principle of Episcopacy, and never formally separated from the Church of England. His collected works were published after his death in thirty-two vols. 8vo. He contributed to the collection of hymns, the greater part of which was written by his brother Charles. *See* METHODISTS.—BIBLIOGRAPHY : C. T. Winchester, *Life of John Wesley*; W. H. Fitchett, *Wesley and his Century*; *The Journal*, edited by N. Curnock; F. J. Snell, *Wesley and Methodism*; R. Southey, *Life of Wesley*.

WESSEX. The district of England which includes the modern counties of Berkshire, Hampshire, Wiltshire, Dorset, and Somerset. It represents the ancient kingdom of the West Saxons, about the origin of which there has been considerable controversy. The older view, that the West Saxon invaders entered the country by Southampton Water and made their first capital at Winchester, has been challenged by writers who trace the earliest West Saxon settlements to the Thames Valley, with an early capital at Dorchester (Oxfordshire).

The West Saxons, having brought the British in Devon and Cornwall under their rule, began to hold a leading place among the English kingdoms, and after the fall of Mercia, in the end of the eighth century, Wessex attained the hegemony in England. Its great King Egbert (802-839) established the power of Wessex over the whole south of England and over East Anglia by the victory of Ellandune (the locality of which is doubtful) in 825, and subsequently extended his supremacy over Mercia and Northumbria. The leadership thus acquired was retained by his descendants, though the power, and even the existence, of Wessex was placed in grave jeopardy by the Danish invasions, which became serious about the time of Egbert's death. His son, Ethelwulf, his four grandsons, Ethelbald, Ethelbert, Ethelred I., and Alfred the Great, and his great-grandson, Edward the Elder, were the leaders of the English in the long, and ultimately successful, struggle with the Danes.

In the course of the conflict, the royal families of the other English kingdoms became extinct, and Edward the Elder was acknowledged as the King of all England. His descendants occupied the English throne until the death of Edward the Confessor in 1065, except for the period of the later Danish invasions (1016-42). The blood of the old English or West Saxon House was brought into the Norman royal family by the marriage of Henry I. to the daughter of the Saxon princess Margaret, who was the wife of Malcolm III. of Scotland. Until after the Norman Conquest, Winchester, the capital of Wessex, was the capital of England, and English history in the ninth, tenth, and eleventh centuries is the history of Wessex.

WEST, Benjamin. English painter, born at Springfield, Pennsylvania, in 1738, died in London in 1820. He visited England in 1763, and was so well patronised that he determined to make it his future residence. He painted *Hector and Andromache*, *The Return of the Prodigal Son*, and an historical painting of *Agrippina*, the last for the Archbishop of York, who introduced him to George III. The latter became his steadfast patron, and gave him commissions to the extent of about £1000 a year for upwards of thirty years. On the death of Reynolds, in 1792, West was elected president of the Royal Academy.

WEST, Rebecca. Pen-name of Cicily Isabel Fairfield (Mrs. H. M. Andrews), English novelist and critic. Born 25th December, 1892, and educated in Edinburgh, she became a member of the staff of *Free Woman*, and *The Clarion*, and a contributor to various important journals in Britain and America. Her works include *Henry James* (1916), *The Return of the Soldier* (1918), *The Judge* (1922), and *Harriet Hume* (1929).

WEST AFRICA. A general term used mainly in the political sense to include certain British and French colonies. British colonies are : Gold Coast (including Ashanti), Sierra Leone, Nigeria, and Gambia. French West Africa is sometimes considered as the whole of the west of that continent, north of the equator, that belongs to France. French colonies are : Ivory Coast (*see* KONAKRY), Upper-Senegal-Niger (French Sudan), Senegal, Upper Volta, and Dahomey. Portuguese Guinea is in West Africa, but Portuguese West Africa is Angola (q.v.). Togoland is now politically non-existent. Liberia is an independent state. Articles on all the above colonies, etc., should be consulted. *See also* AFRICA ; GEOGRAPHY (section II., A. 4) ; COLONY ; FRENCH CONGO ; ANGOLA ; GUINEA ; VOLTA (river) ; SENEGAL (river) ; NIGER (river) ; ASHANTI ; etc. — BIBLIOGRAPHY : *Peace Handbook No. 90, British West Africa* (general) ; *Peace Handbook No. 100, French West Africa* ; both published by H.M. Stationery Office, and dealing with the political history, etc., of the region.

WEST BRIDGFORD. Urban district of Nottinghamshire. It lies to the south of the city of Nottingham, from which it is separated by the River Trent, and of which it is really a residential suburb. The chief building is the church of St. Giles. Pop. (1931), 17,821. East Bridgford is a village 7 miles away.

WEST BROMWICH. A municipal borough of Staffordshire, England. Its manufactures include machinery, tools, and metal work, and there are foundries and smelting furnaces. Other industries are brick-making, tar distillation, and the manufacture of washing powders. Pop. (1931), 81,281.

WESTBURY. An ancient town of Wiltshire, England, on a plain 21 miles north-west of Salisbury. The town has a trade in farm produce, and some manufactures. Pop. (1931), 4044.

WESTCLIFF. A watering-place of Essex, England, between Leigh-on-Sea and Southend. It is included in the borough of Southend.

WESTCOTT, Brooke Foss. Born in 1825, died in 1901. He was assistant-master at Harrow (1852-69), residentiary Canon of Peterborough (1869-83), regius professor of divinity at Cambridge (1870-90), Canon of Westminster (1883-90), and in 1890 he succeeded Lightfoot in the see of Durham. The revision of the Greek text of the New Testament occupied him and Dr. Hort for twenty-eight years, and resulted in the publication of their important work, *The New Testament in the Original Greek*, in 1881. This text formed the basis of the Revised Version of the New Testament.

WEST DERBY. A parliamentary division of Liverpool, forming a wealthy residential suburb of the city.

WEST DRAYTON. Village of Middlesex. It is 13 miles from London by the G.W. Railway, on which it is a junction. It is part of the urban district of Yiewsley and West Drayton. Pop. (1931), 13,057.

WESTERHAM. Market town of Kent. It is 5 miles from Sevenoaks, and 21¼ from London, on the Southern Railway. James Wolfe was born at the vicarage here, and lived at the house now called Quebec House. Westerham Hill (809 feet) is the highest point in Kent. Pop. (1931), 3162.

WESTERN AUSTRALIA. The largest and most westerly state of the Australian Commonwealth, bounded on the east by an arbitrary frontier lying along the 129th parallel of E. long.; area, 975,920 sq. miles; pop. (1932), 422,495 (225,652 males).[1]

Physical. There is a coast-line of 4350 miles, representing one mile of seaboard to 224 sq. miles of hinterland. Westralia [2] is generally a vast undulating plateau (1000 to 2000 feet altitude), a region of internal drainage, with low, rounded hills separated by broad, shallow valleys, and bounded by steep scarps that in places assume the form of hills, as in the Darling range (Mount William, 2500 feet), known in various sections under different names, and running parallel to the west coast at a distance from it of from 18 to 20 miles. Other ranges are: the Stirling range (Bluff Knoll, 3640 feet); Russell range, between Esperance Bay and Israelite Bay; and the Kimberley ranges (Mount Hann, 2800 feet), mountains of Cambrian, Silurian, and Devonian rocks, trending from north-west to south-east, and fringed by a belt of Carboniferous rocks. Mount Bruce (4025 feet) is possibly the culminating point of all the Westralian mountains.

Coastal rivers are more or less short and turbulent, and include, from south to north, the Swan, Greenough, Murchison, Gascoyne, Ashburton, Fortescue, Fitzroy, Drysdale, and Ord.[3]

[1] Full-blooded aboriginals were estimated in 1932 to number 23,000 out of a Commonwealth total of 58,771, and of the former number some 10,000 are out of touch with civilisation. There were 1956 half-caste aboriginals and about 5580 full-blood Asiatics out of a non-European population of 7282 (1624 being half-caste and the rest full-blood).

[2] The term *Westralia* is not official. It was coined by Professor J. W. Gregory as a convenient abbreviation, and is used as such here.—Cf. *Geographical Journal*, vol. xlviii. (1916), note to p. 331.

[3] As already noted, the Plateau is a region of internal drainage, and a prominent physical feature is its lake-system, which, on the map, is clearly defined; but in reality it comprises a series of basins or depressions which, after heavy rains, may form very shallow lakes, although more generally they become large salt-marshes, and in the dry season are mere pans with muddy, salt-encrusted, clay bottoms. There are upwards of 190 of these "lakes," which have been shown by Gregory and others to be of fluviatile origin, and to represent the last vestiges of some proto-historic river-system which, during a period of desiccation, was broken up into a series of basins of internal drainage. The Plateau itself is an uplifted peneplain. During Miocene times it underwent base-levelling of its rivers, and was uplifted about 1000 feet during Pliocene times. The lake-system affords proof of the fact that, at some remote period, Westralia was much better watered than it is to-day, and it is thought that a period of desiccation followed the uplift, which caused a diminution in internal rainfall. The Miocene river-system was then broken up by the inability of its streams to keep their channels free from the invading sand-dunes, and the remnant of these rivers remains in the Westralian lake-system of to-day. Another theory supposes the Westralian lakes to be inlets from some tidal sea, i.e. to be marine, instead of lacustrine and fluviatile. —BIBLIOGRAPHY: J. W. Gregory, *The Lake System of Westralia* (map and bibliography), *Geographical Journal*, vol. xliii. (1914), pp. 656-64; and *The Central Lakes of Westralia and the Westralian Peneplain*, *Geographical Journal*, vol. xlviii. (1916), pp. 326-31, and note on p. 514.

Climate. In the south-west the climate is one of the finest in the world, and may be represented by Perth (197 feet altitude), which enjoys a mean annual temperature of 64° F. (July, 55°; February, 74°) and a mean annual rainfall of from 33 to 34 inches. The highest temperature recorded is 108·4° F., and the lowest 34·2° F. Albany (pop. 1931, 3915), also in the south-west, has a mean annual rainfall of 36·7 inches. Coolgardie (1389 feet altitude) has a mean temperature of 64·4° F. (January, 77°; July, 51°) and a rainfall of 9 inches (1·3 inches in May). Broome (63 feet altitude), in the north-west, has a temperature of 80° F. (January, 86°; July, 70°), rainfall 23 inches; Wyndham (23 feet; on Cambridge Gulf in the far north), 85° F. for the year (November, 90°; July, 76°), rainfall 28 inches; and Nullgara (1265 feet; in Pilbarra gold-field in the north-west), 76·5° F. for the year (January, 90°; July, 59°), rainfall 12·7 inches. *See* climate and physical maps under AUSTRALIA.

Production. Westralia is chiefly important for its minerals, among which gold takes pride of place, followed by coal and silver (as a by-product of lead). Out of a total Commonwealth gold-production of 595,123 oz. during 1931, Westralia's output amounted to 510,572 oz. The total output to the end of 1931 was 38,814,388 oz. There are large deposits of iron ore. Minerals produced in small quantities include: stibnite (the chief ore of antimony), tantalum, scheelite (one of the chief ores of tungsten), molybdenite, manganese (black oxide existing in Kimberley region), cobalt (around Norseman and Kanowna), asbestos, arsenic, tin, alunite, graphite, magnesite, and some precious and semi-precious stones (tourmalines, garnets, emeralds, etc.). Guano deposits exist on Abrothos Island, off the coast, near Geraldton. Almost inexhaustible gypsum deposits are located on the shores of Lake Austin, and large quantities are known to exist at Lake Seabrook. In 1931 there were 5961 miners engaged in the mining of gold.

Westralia is the least developed commercially and industrially of all Australian states.[1] The pearl and pearl-shell fishing dates from 1850, and has its headquarters at Broome, on Roebuck Bay, in the Dampier division. Agriculturally, the state is progressive, wheat yielding an average of 9 bushels to the acre, oats 12 bushels, and barley 11 bushels. Wine-growing and the production of raisins and currants, as well as fruit-growing (nectarines, apples, oranges, pears, plums; and bananas, lemons, and apricots in smaller quantities), are developing rapidly. In the dry region of the plateau, etc., the water-supply presents a problem which is partially solved by the use of Artesian water.[1] For flora see AUSTRALIA. Woods include the jarrah, karri, salmon gum, tuart, and wandoo.

[1] The Northern Territory is not a state, but a Territory of the Commonwealth.

Constitution and Government. Settled in 1829 as the Swan River Settlement, Westralia became a penal settlement in 1850, and remained such until the abolition of transportation in 1868. Responsible government followed in 1890, and in 1900 the colony became a state of the Australian Commonwealth.

The administration is vested in a Governor appointed by the King and assisted by a Cabinet of Ministers. There is a bicameral Legislature consisting of a Legislative Council (30 members, elected from 10 electoral provinces for six years) and a Legislative Assembly (50 members from 50 constituencies, elected for three years). Members of both Houses have free passes over the Government railways, and receive payment at the rate of £600 per annum.

Towns. The capital city is Perth. Claremont (pop. 6400), Boulder (5913), Bunbury (5040), Geraldton (4556), and Albany (3915) are important towns.

Religion. Protestant religious denominations in order of importance are: Anglican (by far the chief), Methodist, Presbyterian, and Congregationalist. Roman Catholicism is the second religion in numerical strength, coming after, but much behind, the Church of England.

Railways. There was, in 1932, a total mileage of 4962, of which 450 miles represented part of the Kalgoorlie-Port Augusta section of the Trans-Australian Railway, Federal property, and on the 4-ft.-8½-in. gauge. State railways had a mileage of 4235, all of 3-ft.-6-in. gauge.

WEST HAM. A county borough of Essex, England, and part of Greater London, about 4 miles E.N.E. of St. Paul's. It is an industrial area. The inhabitants are largely employed in the railway shops at Stratford, in the docks, and in the large factories

[1] See note *Artesian Basins* under *Queensland*. Westralia has five such basins, viz. the Carnar on or North-West Basin, between Burton and Murchison Rivers; the Broome or Gulf Basin, in the far north; the Desert Basin, between Fitzroy and de Grey Rivers; Perth Basin, between Dongarra and Cape Leeuwin, upon which Perth and Fremantle largely depend for their water-supply; and the Eucla Basin, lying along the south coast east of Israelite Bay.

of the neighbourhood. It returns four members to Parliament. Pop. (1931), 294,086.

WESTHOUGHTON. An urban district and parliamentary division in Lancashire, 5 miles W.S.W. of Bolton; with manufactures of silk and cotton, and coal-mining. Pop. (1931), 16,018.

WEST INDIES. An archipelago extending between the coast of Florida on the north and the Venezuelan seaboard on the south, and separating the Atlantic Ocean from the Caribbean Sea and the Gulf of Mexico. The archipelago includes the Bahama Islands, the Greater Antilles (Cuba, Jamaica, Haiti, and Porto Rico), the Lesser Antilles (the Leeward Islands, the Windward Islands, and Barbados), Trinidad, Tobago, and the islands of the Dutch colony of Curaçao. Politically Cuba and Haiti (Haiti and Santo Domingo) are independent, and the rest of the West Indies are divided between Britain, the U.S.A., Holland, and France. Consult all the articles on islands and island groups.

WEST KIRBY. A watering-place of Cheshire, England, on the Mersey, 7½ miles from Birkenhead. Pop. (Hoylake and West Kirby urban district, 1931), 16,628.

WESTLAND. A provincial district on the west coast of South Island, New Zealand; area, 4881 sq. miles; pop. (1932), 16,500. Cattle-rearing, dairying, forestry, and mining (gold, coal, silver, copper, etc.) are carried on. Hokitika is the capital.

WEST LOTHIAN. *See* LINLITHGOW.

WESTMEATH. A county of the Irish Free State, in Leinster, with an area of 435,604 acres. The surface is hilly in the north, but elsewhere undulates gently. The drainage is shared between the Shannon and the Boyne. The former, with its expansion Lough Ree, forms the western boundary of the county; other rivers are the Brosna and the Inny; and there is a group of large loughs. The principal grain-crop is oats, but the larger part of the available surface is devoted to grazing. Important means of communication are furnished by the Shannon, the Royal Canal, and a branch of the Grand Canal. Westmeath was severed from Meath (q.v.) in 1543. The county town is Mullingar. Pop. (1926), 56,818.

WESTMINSTER. A city and metropolitan borough of London. Within the city area are Westminster Hall (*see* LONDON), Westminster Abbey, Westminster Cathedral, the Houses of Parliament, royal palaces, chief Government buildings, etc. Westminster had a royal residence as early as the time of Edward the Confessor, and derives its name from the Minster (the Abbey), which was called "west" to distinguish it from the Minster occupying the site of modern St. Paul's. The Manor of Westminster was a de Mandeville possession at the time of Domesday, but subsequently passed to the Davieses, and then to the Grosvenors, who possess the modern ducal title.

Parks. Among interesting features of the borough are its parks: St. James's, Hyde Park, and Green Park. The first (91 acres) dates in its present form from the reign of George IV.; the second (338 acres) was formed by Henry VIII. in 1536, and was a royal hunting-ground in the time of Elizabeth and a racing centre under Charles I. The Rotten Row (i.e. "Route de Roi"—the King's drive) is a fashionable riding-enclosure at the present day. The Green Park (60 acres) adjoins St. James's Park, and Buckingham Palace overlooks them both.

Buildings. Whitehall is the home of Government offices, and meets at Charing Cross the spacious thoroughfare of the Mall, which runs down in a perfectly straight line to the massive memorial to Queen Victoria that stands before the main gate of Buckingham Palace. On the right are Marlborough House and St. James's Palace, on the left St. James's Park. St. James's Palace, founded about 1188 as a hospital for lepers, was bought and raised to the dignity of a palace by Henry VIII., and was the town seat of sovereigns from Anne to William IV. Marlborough House dates only from 1710, when it was built by Wren for the Duke of Marlborough. It was purchased by the Crown in 1817, and is now town house of the Prince of Wales. Buckingham Palace occupies the site of the seats of the Dukes of Buckingham. It was planned in the reign of George IV. and completed by William IV., and was first occupied by Queen Victoria, who went there in 1837. The palace gardens cover some 40 acres. The Houses of Parliament extend along the river from Westminster Bridge and face Westminster Abbey. A feature is the clock-tower housing "Big Ben," a four-faced clock, each face being 23 feet in diameter. A central tower surmounts the great octagonal hall. Extensive renovations of the Houses of Parliament are now (1933) in progress. Pop. (1931), 129,535.

WESTMINSTER, Duke of. British title held since 1784 by the family of Grosvenor. Hugh Richard Arthur Grosvenor, second Duke of Westminster, was born 19th March, 1879, of the ancient Cheshire family of Grosvenor, and was educated at Eton. He succeeded to the title on the death of his grandfather in 1899. He served with distinction in the Boer War, as A.D.C. to Lord Roberts, and also in the Great War. The family seat is Eaton Hall, near Chester.

WESTMINSTER ABBEY. The coronation church of the sovereigns of England, and one of the chief ornaments of London; it is a magnificent Gothic pile, situated near the Thames, and adjoining the Houses of Parliament. In 1065 a church was built here in the Norman style by Edward the Confessor. Part of this structure still remains in the pyx-house and the south side of the cloisters; but the main building, as it now stands, was begun in 1220 by Henry III. (who built the choir and transepts), and was practically completed by Edward I. Various additions, however, were made (including the nave and aisles, the west front, and the Jerusalem Chamber) down to the time of Henry VII., who built the chapel which bears his name, while the upper parts of the two western towers were designed by Sir C. Wren. The chapel of St. Edmund with his shrine and the Warrior's Chapel were opened in 1932. Excavations in 1931-32 unearthed fragments of the earliest building. The extreme length of the church, including Henry VII.'s chapel, is 531 feet; breadth of transepts, 203 feet; height of the roof, 102 feet; height of towers, 225 feet.

The coronation ceremony takes place in the choir, where the "coronation stone" brought away by Edward I. from Scotland is placed beneath the seat of the king's coronation chair. Westminster Abbey is distinguished as the burial-place of numerous English kings from Edward the Confessor to George II.; the north transept is occupied chiefly by monuments to warriors and statesmen; the Unknown Warrior (q.v.) lies in the nave; while in the south transept is situated "Poets' Corner," the burial and memorial place of most of England's great writers from Chaucer to Browning and Tennyson.—Cf. M. Sturgeon, *Westminster Abbey*.

WESTMINSTER ASSEMBLY OF DIVINES. A celebrated assembly held at Westminster for the settlement of a general creed and form of worship throughout Great Britain. By an ordinance passed 12th June 1643, 121 clergymen, with ten lords and twenty commoners as lay assessors were nominated as constituents of the assembly. The assembly held its sittings from 1st July, 1643, till 22nd Feb., 1649. Among the results of its deliberations were the *Directory of Public Worship*, the *Confession of Faith*, and the *Larger* and *Shorter Catechisms*, which remain practically the standards of the Presbyterians to the present day. At the Restoration the whole proceedings of the Westminster Assembly were annulled as invalid.

WESTMINSTER CATHEDRAL. The chief Roman Catholic Church in England and the seat of the Roman Catholic Archbishop of Westminster. It is situated in the borough of Westminster, an imposing red brick structure in the Byzantine style, with a lofty campanile. Begun in 1895, to the design of John Francis Bentley, it was consecrated in 1910.

WESTMINSTER HALL. The hall of the old palace of Westminster, erected by Richard II. (1397-9) on the foundations of a structure built by William Rufus and completed in 1097. It has a fine porch, and its hammer-beam roof of carved timber is considered the most notable of its kind. Much of the wood of this roof was eaten away by the tunnelling larvæ of the death-watch beetle (*Xestobium tessellatum*), and the roof was restored and reinforced with steel between 1914 and 1923. The length of the building is 290 feet, breadth 68 feet, and height 110 feet.

This building is closely associated with many stirring events in English history; but it is chiefly remarkable as the place where were held such great State trials as those of the Chancellor More, Lady Jane Grey, the Earl of Strafford, King Charles I., and Warren Hastings, and as the centre of the highest English courts of law till these were removed in 1883 to the new buildings erected for their accommodation. The hall now serves as a fine vestibule to the Houses of Parliament.

WESTMINSTER SCHOOL, or **ST. PETER'S COLLEGE,** Westminster. One of the great public schools of England; it was founded in 1560, and was reorganised in 1868. There are forty foundationers, the number of vacancies yearly being ten. The playing fields are in Vincent Square; there is also a ground at Grove Park, bought in 1932. Among the famous headmasters of Westminster School were Nicholas Udall, Dr. Busby, and James Gow. Among its famous pupils

were Ben Jonson, Dryden, Warren Hastings, and Gibbon.

WESTMORLAND. A county in England, bounded by Cumberland, Lancashire, Morecambe Bay, Yorkshire, and Durham; area, 504,917 acres. The surface, with the exception of a small portion in the south sloping to Morecambe Bay, is very mountainous. The Pennine Chain, entering it at Cross Fell on its northern frontier, stretches across it in the north-east, and then curves round, forming the boundary between it and Yorkshire; while the principal chain of the Cumbrian Mountains forms its boundary from Helvellyn (3118 feet) to Bow Fell (2959 feet), and sends a lofty branch nearly across its centre. Much of the celebrated lake-scenery of England is within the limits or on the borders of this county, the chief lakes being Ullswater, Grasmere, Rydal Water, and Windermere. The principal rivers are the Eden, Lune, and Kent.

The minerals include graphite, roofing-slate, marble, and small quantities of coal, lead, and copper. The arable land is mostly confined to the valleys, while the greater part of the remaining surface is in natural pasture, or under wood. Appleby is the county town. Pop. (1931), 65,398.

WESTON-SUPER-MARE. A seaport and watering-place in England, in the county of Somerset, on the Bristol Channel. It is recommended as a place of resort both in winter and summer. Near are the two islands of Flat Holme and Steep Holme, and on the mainland is Brean Down, a sanctuary for wild birds. Pop. (1931), 28,555.

WESTPHAL BALANCE. An apparatus used for finding the specific gravity of milk. The essential part is a steel yard, with ten notches on the longer side. To find the specific gravity of any milk, a quantity is mixed and poured into a glass cylinder, the plummet hanging from the end hook being completely immersed in it. The largest rider is hung on the hook, and the other riders are adjusted on suitable notches until the pointer indicates equilibrium, when the specific gravity is read off by counting one for the rider on the hook, and the second, third, and fourth decimal places for the notches carrying the second, third, and fourth riders respectively. The milk sample is tested at 60° F., or a correction must be made in the reading.

WESTPHALIA (Ger. *Westfalen*). A western province of Prussia, Germany; area, 7804 sq. miles; pop. (1925), 4,784,169. It consists of a part of the North German Plain centring at Münster (the capital), and enclosed by the hills of the Teutoburger Wald and the Sauerland, and by the Rhine Valley on the west. Navigable streams include the Ruhr, Lippe, Weser, and Ems.

Westphalia is chiefly noted as the locus of the Ruhr coal-basin, and is one of the most highly industrialised regions on the face of the earth. After coal, iron is next in importance. Zinc, lead, antimony, salt, and mercury are also mined. Manufactures include linens and textiles generally (Bielefeld, Herford, Warensdorf, etc.), sugar, paper, glass, chemicals (especially sulphuric acid), and pottery; but iron and steel is the paramount manufacture, centring on Essen and embracing whole towns, such as Bochum, Dortmund, Hagen, Siegen, Lüdenscheid, and Altena.

WEST POINT. The Sandhurst of the United States, the military academy of the United States army. It occupies a reservation of some 3500 acres on the right bank of the Hudson River, in Orange county, New York State, and is served by the West Shore Railway. An officers' academy was established there in 1794, but was reconstituted more or less in its present form by President Jefferson during 1802.

WESTPORT. A seaport of the Irish Free State, county of Mayo, at the mouth of a small river in Clew Bay. It is a bathing-resort, and has a trade in agricultural produce. Pop. (1926), 3490.

WEST VIRGINIA. A state in the South Atlantic division of the United States. It is entirely inland, and is bounded on the west for some 3000 miles by Ohio River, from which the surface rises eastwards to the Alleghany Mountains, a massive, rugged, limestone plateau drained almost entirely to the Ohio. In the north-east is a valley zone drained mainly to the Potomac. A thin, northward extension of the state between Pennsylvania and Ohio is known as the Panhandle.

Towns and Communications. Charleston is the state capital; other towns are Huntingdon (pop. 1931, 75,572), Wheeling (61,659), Parkersburg (29,623). There were, in 1932, 4125 miles of steam and 381 miles of electric railway, and transport on the Ohio is highly developed.

Products. Although the state may be classed as primarily an agricultural one, it is also the second producer of minerals in the United States, and its vast coal-field, tapped by rail and river, covers 17,280 sq. miles, and

produced 99,769,000 short tons of coal in 1931. There are also extensive petroleum and natural-gas resources. Manufacturing industries are important. Besides the ordinary cereal crops, hay, roots, etc., West Virginia produces apples, grapes, peaches, and plums, and a large amount of tobacco. Dairying and sheep-farming are progressive.

People, etc. Of a total population of 1,729,205 (1930), 114,893 were negroes, and 51,520 were aliens (12,088 Italians, 5,545 Poles, 3282 English, and 3129 Germans). Roman Catholic, Presbyterian, Methodist, and Baptist are the chief religious denominations. Primary instruction is compulsory between the ages of eight and fourteen years, and is free at all ages from six to twenty-one. The West Virginia University is located at Morgantown. State area, 24,282 sq. miles (260 sq. miles being water).

Constitution. West Virginia, formed in 1862 from the western portion of the state of Virginia, was admitted to the Union in 1862. There are 55 counties. The Legislature is bicameral, comprising a Senate (30 members, elected for four years, one-half seeking biennial re-election) and a House of Delegates (94 members, elected for two years). Two Senators and 6 Representatives are sent to Congress.

WESTWARD-HO. A holiday resort of England, in the county of Devon, on Barnstaple Bay, about 3 miles north-west of Bideford. It has a golf course. Westward-Ho College is a military school, celebrated as the school described in Kipling's *Stalky and Co.* It is part of the urban district of Northam.

WETHERBY. Market town of Yorkshire (W.R.). Situated on the Wharfe, it is about 12 miles N.W. of Leeds and 195½ miles from London, on the L.N.E. Railway. It is an agricultural centre, and brewing is carried on. Pop. (1931), 2126.

WETZLAR. A town of Rhenish Prussia, at the junction of the Lahn and Dill. It was anciently a free imperial town, and was the seat of the imperial German court of justice from 1698 to 1806. Pop. 16,482.

WEXFORD. A maritime county of the Irish Free State, in the province of Leinster, bounded by Wicklow, St. George's Channel, the estuary of the Suir and Barrow, Waterford Harbour, Kilkenny, and Carlow; area, 580,894 acres. The chief inlet on the east coast is Wexford Harbour, which, though spacious is of intricate navigation and obstructed by a bar. The surface of the interior is hilly, rising into a ridge on the north-west, declining into a level peninsula to the south-east. The chief rivers are the Slaney and Barrow. The prevailing soil is stiff clay, generally well cultivated, and producing oats, wheat, barley, and potatoes. The fisheries are extensive. Pop. (1926), 95,848.

WEXFORD. The county town of Wexford, Irish Free State, a seaport on the River Slaney, where it enters Wexford Harbour. The town has a county court-house, town hall, prison, theatre, barracks, and a Roman Catholic college. The herring and salmon fisheries employ many persons; malt is manufactured, and distilling, brewing, and shipbuilding are carried on. The chief trade is in exporting grain, cattle, poultry, and butter. Pop. (1926), 11,870.

WEXIÖ, or VEXIÖ. A town of Southern Sweden, in the län of Kronoberg; served by the Alfvesta-Carlskrona Railway, etc. It is a cathedral town, the seat of a bishop, and has iron-founding, brewing, and match-making industries. Pop. 9699.

WEYBRIDGE. Urban district of Surrey. It is situated on two rivers—the Wey and the Thames—18 miles from London, on the Southern Railway. It is principally a residential district, being near several good golf courses and only a few miles from Brooklands, the station for which is known as West Weybridge. There is a fine, open common. Pop. (1931), 7359.

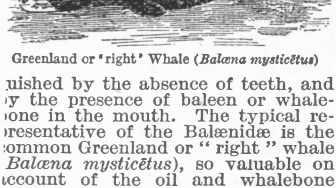
WEYGAND, Maxime. French cavalry general. He was born at Brussels, 21st Jan., 1867. Throughout the Great War he was the assistant and trusted adviser of General Foch. He conducted a successful campaign against the Bolsheviks in Poland in 1920 and liberated Warsaw. In 1923-6 he was High Commissioner in Syria, in 1930 Chief of the General Staff.

WEYMAN, Stanley John. English novelist; born in 1855, was educated at Shrewsbury School, and Christ Church, Oxford, where he graduated in 1877. Called to the Bar in 1881, he practised for a time. In 1890 he began his literary career by an historical romance entitled *The House of the Wolf.* His reputation was first secured by his brilliant story of the French Huguenots, *A Gentleman of France* (1893). His later novels, mainly historical, include: *Under the Red Robe* (1894), *My Lady Rotha* (1894), *The Red Cockade* (1895), *The Man in Black* (1896), *Shrewsbury* (1897), *Count Hannibal* (1901), *Starvecrow Farm* (1905), *Chippinge* (1906), and *The Great House* (1919). He died in 1928.

VEYMOUTH AND MELCOMBE-GIS. A seaport and municipal ough of Dorsetshire, England. ymouth is on one side, Melcombe-is on the other of the small river y, over which is a bridge. There considerable coasting trade, the of export being Portland stone. lcombe-Regis attracts numerous itors both in summer and winter, ing to its bathing facilities and mild ter climate. There is a large traffic h the Channel Islands. It has a esplanade. Pop. (1931), 21,982.

WHALE. The common name given the larger mammals of the order tacea (q.v.). They are characterised having fin-like anterior limbs, the sterior limbs being absent, but ving their place supplied by a large rizontal caudal fin or tail. Their ode is in the sea or the great rivers, d they resemble the fishes so closely external appearance that even me of the earlier zoologists regarded em as belonging to that class.

The Balænidæ and Balænopteridæ, whalebone whales, are distin-



Greenland or 'right' Whale (*Balæna mysticētus*)

guished by the absence of teeth, and by the presence of baleen or whale-bone in the mouth. The typical representative of the Balænidæ is the common Greenland or "right" whale (*Balæna mysticētus*), so valuable on account of the oil and whalebone which it furnishes (*see* BLUBBER; WHALEBONE). It principally inhabits the Arctic seas, but it is also found in considerable numbers in many other parts of the world. Its length is usually about 60 feet, and its greatest girth of body from 30 to 40 feet. The plates of baleen serve to strain out from the water taken into the mouth the pteropoda or other small creatures on which these large animals chiefly subsist. The nostrils open on the top of the head, and are known as "blow-holes;" through these air from the lungs is expired, but water is not ejected in the act of "blowing" or "spouting."

The Balænopteridæ include the rorquals, distinguished by a smaller head, furrowed throat, and the possession of a dorsal fin (*see* RORQUAL). Of the Physcteridæ, which have no baleen plates, and are also known as "toothed whales," the best-known species is the sperm-whale or cachalot (*Physeter macrocephălus*), which averages from 50 to 70 feet in length (*see* SPERM-WHALE). This family also includes the smaller beaked whales (Ziphius, Hyperoödon, etc.). Some species of the Delphinidæ or dolphin family are also known as whales (*see* BELUGA; CAAING-WHALE).

Whale fishing for the sake of the oil and whalebone was an important industry even in the twelfth century. It was for long prosecuted with great energy by the Dutch, English, French, and Americans, but in recent times it has greatly decreased, chiefly on account of the scarcity of whales. The instruments used are the harpoon and the lance. The harpoon is an iron weapon about 3 feet in length, terminating in an arrow-shaped head. This is attached to a line, and is thrown at the whale by hand, so as to pierce it, or is discharged from a small swivel cannon placed in a boat. The lance is a spear of iron about 6 feet in length, with a thin sharp steel head. These, with the necessary lines, boats, etc., are all the apparatus required for capturing the whale. When captured the animal is cut up, the blubber boiled and the oil extracted and the whalebone dried. Hermann Melville's book *Moby Dick*, published in 1851, gives a vivid description of whaling in those days.

WHALEBONE, or **BALEEN.** A well-known elastic horny substance which hangs down in thin parallel plates from the sides of the upper jaw of the family of whales called Balænidæ (*see* WHALE). These plates or laminæ vary in size from a few inches to 12 feet in length; the breadth of the largest at the thick end, where they are attached to the jaw, is about a foot, and the average thickness is from four- to five-tenths of an inch. On account of its flexibility, strength, elasticity, and lightness, whalebone was once employed for many purposes. Makers of umbrellas and corsets now use steel instead, but whalebone, though very scarce and dear, is still used in the brush industry. In commerce the plates of baleen are often called *whale-fins*.

WHALE-LOUSE (*Cyămus ceti*, order Amphipoda). A genus of small crustaceans, so named from living a parasitic life on whales and other cetaceans.

WHALLEY. Village of Lancashire. It is 26¼ miles from Manchester and 6 from Blackburn, on the L.M.S. Railway. The parish church was once that of a Cistercian abbey of which some remains still exist. Pop. (1931), 1378.

WHAMPOA. A port of China, on an island of the same name, 12 miles east of Canton, with commodious docks, etc., for the cleansing and repair of vessels.

WHARTON, Edith. American novelist, born in New York in 1862. Her work, which is mainly concerned with American life and character, has won her a high reputation among contemporary writers, and has gained for her many honours in her own and other countries. Among her works may be mentioned *Ethan Frome* (her masterpiece, published in 1911); *The House of Mirth*; *The Hermit and the Wild Woman*; *The Age of Innocence*; and *Hudson River Bracketed* (1930).

WHARTON, Thomas Wharton, Marquess of. Born 1640, died 1715; the reputed author of the celebrated political ballad *Lillibullero* (q.v.), who was severely castigated by Swift.—His son, Philip Wharton (1699-1731), was created a duke in 1718. Like his father, he lived a very profligate life, and is now chiefly remembered as the subject of Pope's satire, as his father was of Swift's.

WHATELY, Richard. British prelate and scholar, born in London in 1787, died in 1863. He received his education at a private school at Bristol, and at Oriel College, Oxford, graduated B.A. in 1808, and in 1810 won the English essay prize. In 1819 he made his first appearance as an author by publishing his famous *Historic Doubts relative to Napoleon Bonaparte*. In 1827 appeared his *Elements of Logic*, and in 1828 his *Elements of Rhetoric*. Both these works were written originally for the *Encyclopædia Metropolitana*.

He occupied the chair of political economy at Oxford in 1830-1, and afterwards published *Introductory Lectures on Political Economy*. In 1831 he was appointed Archbishop of Dublin, a position in which he did much for national education and other worthy objects in Ireland, including the foundation and endowment of a chair of political economy in Trinity College.

WHEAT (*Triticum sativum*). The most important species of grain cultivated in Europe, and a great crop in North America, India, Argentina, Australia, etc. It grows readily in almost every climate; but its natural home seems to be a temperate climate, and the soils best adapted for its culture are rich clays and heavy loams. Of cultivated wheats there are many varieties, the differences, however, being partly due to soil, climate, and mode of cultivation. Three primary varieties may be mentioned: (*a*) *T. hybernum* (*muticum*), winter or unbearded wheat; (*b*) *T. æstivum* (*aristatum*), summer or bearded wheat; (*c*) *T. Spelta* (*adhærens*), spelt or German wheat, which is of much less value than the others, but grows on poorer soils and more elevated localities.

White wheat and red wheat are names applied according to the colour of the grain; the red sorts are generally hardier than the white, but are of inferior quality, and the yield is less. Winter wheat is sown in the autumn, with the view of being harvested the following year; summer wheat is sown in the spring of the year in which it is reaped. The best English wheat yields from 75 to 85 per cent of fine flour, the inferior kinds only from 54 to 68 per cent. *See* FLOUR.

WHEAT-EAR (*Saxicŏla œnanthe*). A perching bird of the thrush family. Its average length is 6¼ inches, and its colour grey above, breast brown, and under parts white. The wheat-ear, also known as the *fallow-chat*, is a summer visitant in Britain.

WHEATLEY. Urban district of Oxfordshire. It is 6 miles from Oxford and 48¼ from London, on the G.W. Railway. Pop. (1931), 1269.

WHEATSTONE, Sir Charles. British physicist and inventor; born at Gloucester in 1802, died at Paris in 1875. Before he was of age he commenced business for himself in London as a maker of musical instruments, and in 1823 attracted the attention of men of science by the publication in Thomson's *Annals of Philosophy* of a paper entitled *New Experiments on Sound*. This was followed by a number of other papers, some of them describing inventions of his own, all of which are remarkable for their ingenuity and delicacy of mechanical construction.

In 1834 Wheatstone was appointed professor of experimental philosophy in King's College, London, but he seldom lectured. In 1836 he exhibited at King's College experiments showing the velocity of electricity, which suggested to him the idea of applying his apparatus to telegraphing, and in 1837, in conjunction with W. F. Cooke, he took out the first patent for the electric telegraph. His name is perpetuated in "Wheatstone's Bridge" (q.v.). He was a Fellow of the Royal Society from the year 1836, and in 1868 he received the honour of knighthood. He was the author of numerous papers, chiefly contributed to the *Philosophical Magazine* and the *Journal of the Royal Institution*.

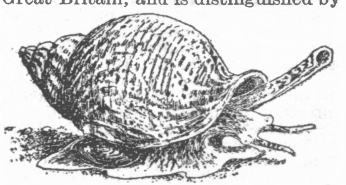
WHEATSTONE'S BRIDGE. An electrical instrument much used for measuring resistances. It has heavy brass connectors to provide means for joining the known and unknown resistances in series, and for joining these resistances in parallel with a uniform wire of some definite length, say a metre. The current from the battery will be divided between the two arms of the circuit. The drop in pressure per unit length along the uniform wire will be constant. If the connection from the galvanometer is moved along the wire of the instrument, the current in the galvanometer will vary, and it will vanish altogether if the point of connection is suitably chosen. When this point is obtained, the drops in pressure through the resistances will be equal to those in the parts of the instrument wire on either side of the balance point. As the lengths of the wire are proportionate to the resistance, the ratio of the values of the two resistances can be readily obtained, and since one is known, the other can be easily calculated.

A simple method of measuring resistance is to connect the coil in question to a suitable source of supply and measure the pressure drop across the coil and the current passing. Ohm's law gives the means of determining the resistance, for $R = V/i$. Insulation resistances are measured by applying a known electrical pressure—in the case of house and factory wiring this is usually 500 volts, obtained from a small hand-rotated generator (*see* OHMMETER)—to the circuit. The current passing gives an index to the value of the insulation, but the instrument is graduated in megohms to facilitate the work. The insulation from the system to earth is measured, as well as that from the one cable to the other, after all lamps and other connections between the two sides of the system are out of circuit. The determination of the position of faults in cable systems by the measurement of resistance is of considerable service to the electrical engineer.—BIBLIOGRAPHY: H. R. Kempe, *Electrical Testing*; J. A. Fleming, *Handbook for the Laboratory and Testing Room*; F. C. Raphael, *Localization of Faults in Electric Light Mains*.

WHEEL AND AXLE. A mechanical device consisting of a combination of a pulley, usually grooved, and a drum fixed to rotate together. It is merely a form of lever by means of which a small effort is used to raise a heavier load. The radii of pulley and drum are the arms of the lever, and the fulcrum is on the common axis of the pulley and drum. The system has many advantages over that of the simple lever, for the actions are not confined to a small lift, as the revolving system may be turned many times in the process of working. The winch, windlass, and capstan are applications of the wheel and axle.

WHEELING. A city and port of West Virginia, United States, the largest city in the state and the county seat of Ohio county, on Ohio River; served by the Baltimore, Ohio, and other railways. It is the most important place on the river between Pittsburg and Cincinnati. Coal is largely worked in the neighbourhood; there are iron-foundries and forges, nail-, glass-, and paper-works, cotton, silk, and steam-engine manufactories, and a brisk traffic by river and railroad. Settled in 1769, it was chartered as a city in 1836. Pop. (1930), 61,659.

WHELK. A general name applied to various species of sea-snails. The large or common whelk (*Buccinum undātum*) is found on the coast of Great Britain, and is distinguished by



Dog-whelk, with Body exposed

the shell having its canal notched, and the mouth or aperture of large size. The whelks are typically carnivorous. They are largely used for food and bait.

WHEWELL (hū'el), **William.** English scholar and philosopher; born in 1794, died in 1866. From Haversham Grammar School he went to Trinity College, Cambridge, where he graduated B.A. in 1816, as second wrangler and second Smith's prizeman. In 1828 he was elected professor of mineralogy. In 1832 he resigned this chair for that of moral philosophy, which he held till 1855, when he became vice-chancellor of the university. In 1841 he was nominated to the mastership of Trinity, and in this position did much to secure for the natural and moral sciences a better recognised position among the studies of the university. He became Fellow of the Royal Society in 1820, and was one of the first members of the British Association, of which he was president in 1841.

Among Whewell's multifarious writ-

ings may be mentioned the Bridgewater treatise, *Astronomy and General Physics, considered with reference to Natural Theology* (1833); *History of the Inductive Sciences* (1837); *Philosophy of the Inductive Sciences* (1840); *History of Scientific Ideas*; *On Liberal Education in General*; and *Lectures on Political Economy* (1863).

WHICKHAM. Urban district of Durham. It is 3½ miles from Gateshead. The industries are connected with steel and chemicals. Pop. (1931), 20,782.

WHIG. The term "Whig" or "Whiggamore" is Scottish in origin; it is believed to be derived from a word addressed to their horses by carters belonging to the south-west of Scotland when fetching supplies from Leith. The word was therefore applied to the drivers themselves, and when a body of Covenanters from the south-west marched upon Edinburgh in 1648, it was known as the Whiggamores' Raid.

From that time "Whig" was a contemptuous term for the extreme Presbyterians, and in the reign of Charles II. it was used for the Covenanters who opposed the king. Hence it came to be employed in England, also originally as a term of ridicule for the Opposition which denied the divine right of kings and proposed to interfere with the natural order of the succession by excluding the Duke of York from the throne. The early Whig party was discredited by the credence which it gave to the Popish Plot and by the Rye House Conspiracy, but it was revived by the misgovernment of James II., and the leading spirits of the Revolution were a body of Whig noblemen and gentlemen.

In the reigns of William III. and Anne the Whig party were the supporters of the Revolution settlement and of war with France, and the opponents of a Stewart restoration. They were out of office in the last four years of Anne's reign, but the accession of George I. gave them a permanent lease of power, for the House of Hanover could not employ the Tories, who were suspected of Jacobitism. One Whig ministry succeeded another until after the accession of George III., and the party naturally split into cliques and factions. Divisions among the Whigs continued even after the Tories, purged of Jacobite tendencies, became their rivals, and during the latter half of the reign of George III. the party became unpopular because of its opposition to the French war. It regained credit and popularity in the struggle for parliamentary reform, and the Reform Act of 1832 was carried by a Whig ministry. Soon afterwards the name Whig came to be regarded as old-fashioned, and was abandoned in favour of the new term "Liberal."

WHIN. *See* GORSE.

WHIN-CHAT. A small perching bird of the thrush family (*Pratincŏla rubetra*). It is common in the British Islands during summer, frequenting broom and furze, on the highest twigs of which it perches, and occasionally sings very sweetly. It is closely allied to the stone-chat (q.v.).

WHIPPING. A punishment inflicted by the law of England chiefly for minor offences. The Criminal Law Consolidation Acts (24 and 25 Vict. cap. xcvi.-c., 1861) enumerate several offences for which the punishment may be inflicted on males under sixteen. A subsequent Act enacts that when the offender is under fourteen the number of strokes is not to exceed twelve.

The Criminal Law Amendment Act, 1912, provides that any male person convicted of certain offences against morality may now be whipped in addition to any other punishment. Act 26 and 27 Vict. cap. xliv. enacts that, in all cases of robbery or intent to rob, where the attempt is accompanied by personal violence, the court may, in addition to the other punishments provided by the laws, direct that the offender, if a male, be once, twice, or thrice privately whipped. This law was chiefly aimed at the practice of garrotting (*see* GARROTE). By 1 Geo. IV. cap. lvii. it was enacted that no female shall be whipped.

WHIPPINGHAM. A village of the Isle of Wight. It stands on the Medina, about 4 miles from Newport. Near is Osborne House, a favourite residence of Queen Victoria. Pop. 2033.

WHIP-POOR-WILL. The popular name of an American bird, the *Antrostŏmus vocifĕrus*, allied to the European goat-sucker or night-jar, and so called from its cry. It is very common in the eastern parts of the United States; is about 10 inches long, and feeds on flying moths and other insects. Its note is heard in the evening, or early in the morning. During the day these birds retire into the darkest woods.

WHIPSNADE. District of Hertfordshire. It is 34 miles from London and 3 from Dunstable. Formerly part of the Ashridge estate, it was bought in 1927 by the Zoological Society and laid out as a zoological garden where many of the animals live in the open air.

WHIRLWIG, or **WHIRLWIG-BEETLE** (*Gyrinus natātor*). A beetle which abounds in fresh water in Britain, and may be seen circling round on its surface with great rapidity. Its eyes are divided by a narrow band, so that, although it has only two, it looks as if it had four.

WHIRLWINDS. Violent winds revolving round a vertical axis, being in this respect similar to, though much smaller than, tropical cyclones. On the smallest scale they may be seen in the dust-whirls which sometimes occur in hot weather. The axis has a progressive movement along the earth's surface. They are most common in desert regions, being produced by the intense heating of the ground, with resulting rapid convection. Sand, dust, and articles of all kinds may be lifted up into the air and scattered promiscuously.

Storms of this kind occasionally happen even in Britain. On 27th Oct., 1913, a cyclone travelled along the west of England, accompanied by lightning and very heavy rain. It lasted at a given place 4½ minutes, and had a track only 150 yards wide. On its course it stripped trees of their branches or uprooted them. In one locality several cows were lifted over a high hedge into an adjoining field, and three were killed. Exactly three years later, on 27th Oct., 1916, and again on 27th July, 1918, whirlwinds passed through Essex. In the former case thousands of oaks and elms were seriously injured, and the village of Writtle suffered damage to the extent of over £3000.

WHISKY. *See* WINES AND SPIRITS.

WHIST. Long the leading card-game of the English-speaking race, developed from *trump* or *triumph*, popular in the sixteenth century. It was once also known as *whisk*, both names apparently referring to the need for silence during play. Whist is played by four players, two against two, with a full pack of cards. The partnerships are usually decided by "cutting," the two lowest playing the others. A second cut is made for "deal," the lowest dealing. In cutting the ace is the lowest card; in play it is the highest, being followed by king, queen, knave, ten, etc. When dealing to himself the fifty-second card, the dealer exposes it; and that suit is "trumps" for the hand. He puts the card in his own hand when the first trick is taken up. Sometimes—especially in the United States—the exposure of a card is avoided by drawing a card for trumps, and then reshuffling the pack.

The player on the dealer's left leads, most often from his strongest suit, though a "singleton," if he has one, may often be led with advantage. Players must follow suit if able to do so; failing this, they may "discard" or trump the trick. A general rule is that the second player—the dealer's partner—should play low, the third hand playing high to take the trick. All tricks secured above six count; "honours"—ace, king, queen, knave—are also counted towards the game, though not in favour of a partnership whose score is four.

In short whist, now practically universal, five is "game." The "rubber" is two games out of three; if two successive games are won by the same side, the third is not played. Honours are "easy," nothing being scored, when two are held by either side; three honours on one side count "two," while four count "four" as points. Two points are also scored for the rubber, and others in a somewhat complicated manner for each "game." Cavendish's *Principles of Whist* (1902), is one of the soundest handbooks.

WHISTLER, James Abbott M'Neill. Painter and etcher, born at Lowell, Massachusetts, in 1834, died in London 1903. He studied in Paris under Gleyre, identified himself with the Impressionists, and exhibited with Manet, Monet, and others at the 1863 Salon des Refusés. In 1863 he came to London, where he remained the rest of his life, save for occasional residences in Paris.

Much influenced by Japanese art, Whistler laid great emphasis in his work on design, and on harmony of colour and tone. Characteristic of him are the series of "nocturnes" and "symphonies" in which one colour dominates the whole picture, much as the key does a piece of music. In his portraits the influence of Velasquez, with his fondness for silhouetting, is evident. Important examples are: *The White Girl* (1862); *Portrait of My Mother* (1872); *Portrait of Carlyle* (1872), purchased by Glasgow Corporation in 1891; *Miss Alexander* (1888), now in the Tate Gallery; and *Sarasate*. His usual signature on his pictures was his monogram in the form of a butterfly. As an etcher and lithographer Whistler is in the first rank. The irony and power of invective which made him a conspicuous social figure are well reflected in his writings, notably *The Gentle Art of Making Enemies* (1890) and *The Baronet and the Butterfly* (1899).

WHITBY. A seaport and watering-place of England, in the North Riding of Yorkshire, at the mouth of the Esk, which divides it into two nearly equal parts, and is spanned by a stone

bridge with a movable centre-portion for admitting vessels into the inner harbour. The town is situated on bold acclivities, and has the ruins of an ancient Benedictine abbey (A.D. 657). Jet ornaments are made, jet being found there; and the fisheries are important. Whitby was one of the towns shelled by German battle-cruisers on 16th Dec., 1914. Pop. (1931), 11,441.

WHITE, Gilbert. British naturalist, born in 1720 at Selborne, in Hampshire, died in 1793. He was educated at Oriel College, Oxford, of which he became a Fellow in 1744. He declined all Church preferment, but in his latter years served as curate in his native village. His *Natural History of Selborne* was published in 1789, and has retained a deserved and unimpaired popularity to the present day. He was also the author of letters on the antiquities of Selborne.—Cf. Rashleigh Holt-White (editor), *The Life and Letters of Gilbert White of Selborne.*

WHITE, Henry Kirke. English poet, born in 1785, died in 1806. He was the son of a butcher, but through the exertions of several friends he was admitted a student of St. John's College, Cambridge. There he applied himself to his studies with such unremitting labour that he became ill and died. His *Remains*, consisting of poems, letters, etc., were edited by Southey. His reputation, which was due in part to his early death, has not lasted; and his poems, which are innocuous but mawkish, are largely forgotten.

WHITE-BAIT. A name for the young of the herring and sprat, long regarded as a distinct fish, or as the fry of the shad. It abounds in the Thames during spring and summer, and is much prized by the Londoners. It has a length of 2 to 5 inches, and is pale silvery in colour with a greenish hue on the back. It is not peculiar to the Thames, but occurs in the Clyde, Forth, and elsewhere.

WHITE CITY. Name given to an exhibition ground at Shepherd's Bush, London. It was opened in 1908 and a number of exhibitions were held there, except during the war period (1914-8) when it was used for military purposes. It possesses a stadium and a track for greyhound racing. In 1932 a cinder track was constructed for athletic meetings.

WHITEFIELD. Urban district of Lancashire. It is 6 miles from Manchester and 193 from London by the L.M.S. Railway, and is a centre of the cotton industry. Pop. (1931), 9107.

WHITEFIELD, George. English evangelist and founder of the Calvinistic Methodists, born in 1714 at Gloucester, died at Newburyport, Mass., in 1770. At the age of eighteen he entered as servitor at Pembroke College, Oxford, where he became acquainted with the Wesleys, and joined the small society which procured them the name of Methodists. He was ordained deacon in 1736, and soon became very popular as a preacher. In 1738 he went to the American settlement of Georgia, where his ministrations gave great satisfaction to the colonists.

In the following year he returned to England to procure subscriptions for building an orphan-house in the settlement. Having taken priest's orders, he repaired to London, where the churches in which he preached proved incapable of holding the crowds who assembled to hear him. He now adopted preaching in the open air, and visited various parts of the country, addressing vast audiences.

In 1739 he again embarked for America, and made a tour through several of the provinces, preaching with great effect to immense crowds. He returned to England in the following year, where for a time differences between him and Wesley deprived him of many followers. After visiting many parts of England, Scotland, and Wales he again returned to America, and remained there nearly four years. Soon after his return he was introduced to the Countess of Huntingdon, who made him one of her chaplains. A visit to Ireland and two more voyages to America followed, and for several years his labours were unremitting.—Cf. Luke Tyerman, *Life of George Whitefield.*

WHITEHALL. A locality in Westminster, where are the Admiralty Office, the Horse Guards, and other important Government offices. In the middle of the thoroughfare is the cenotaph erected in memory of those who fell in the Great War. On the bank of the Thames was a palace called Whitehall, built before the middle of the thirteenth century. In 1530 it became the residence of the court, but in 1697 was destroyed by fire, excepting the Banqueting House added by James I., from a design of Inigo Jones, in 1619. Charles I was executed in front of Whitehall and Cromwell died there. The Banqueting House is now the United Service Museum.

WHITEHAVEN. A municipal borough and seaport of Cumberland England, on a bay of the Irish Sea has a custom-house, market-house

good harbour and dock, and enjoys a considerable shipping trade. The principal exports are coal, pig-iron, rails, and iron ore. Shipbuilding is carried on, and there are blast-furnaces and iron- and brass-foundries. The coal- and iron-mines in the neighbourhood raised Whitehaven to importance as a seaport. Pop. (1931), 21,142.

WHITE HOUSE. Official residence of the president of the United States. It is at Washington and has been used for its present purpose since 1800.

WHITE MOUNTAINS. A range in the north-east of the United States, in New Hampshire, belonging to the Alleghanies. They have fine scenery, and are a favourite summer-resort. The culminating point is Mount Washington (6288 feet).

WHITE RIVER. (1) A river of Arkansas, United States, with a course of 800 miles. It joins the Mississippi above the influx of the Arkansas River, and has several important affluents. Together with its tributaries it affords 500 miles of boat navigation. (2) A river in Indiana, formed by the confluence of the East and West Forks.

WHITE RUSSIA. *See* RUSSIA (table).

WHITE SEA. A large gulf of the Arctic Ocean, penetrating into Northern Russia to the distance of between 300 and 400 miles. It has an area of about 47,000 sq. miles, with a coastline of 1000 miles. It is navigable only from the middle of May to the end of September, being frozen over the rest of the year. About thirty rivers, among which the principal are the Northern Dwina, the Onega, and the Mezene, empty themselves into the White Sea. At the mouth of the Dwina lies Archangel, the commercial emporium of this region. Two canals, uniting the Dwina with the Volga and the Dnieper, connect the White Sea with the Caspian and Black Seas. *See* MURMAN.

WHITE-SWELLING. The popular name for all severe diseases of the joints resulting from chronic inflammation in the bones, cartilages, or membranes constituting the joint.

Among the diseases known under this name are: (*a*) acute or chronic inflammation of the synovial membrane; (*b*) pulpy thickening of the synovial membrane; (*c*) ulceration of the cartilages; (*d*) tubercular diseases of the joints beginning in the bones. They may arise as effects of phlebitis, gout, rheumatism, syphilis, tuberculosis, or mercury. The knee, ankle, wrist, and elbow are the joints most subject to white-swellings.

WHITE-THROAT. A small singing bird of the warbler division of the thrush family. The common white-throat (*Sylvia cinerea*) attains a length of 5 inches, frequents gardens and hedges, and is a regular summer visitor to the British Islands. The lesser white-throat (*S. currūca*) is also a summer visitor to Britain.

WHITGIFT, John. English prelate, born 1530, died 29th Feb., 1604. Educated at Cambridge, he imbibed from his uncle, Abbot Whitgift, opinions that inclined him later to the side of the Reformation. By a cautious reserve, however, he escaped persecution during the reign of Queen Mary, and on the accession of Elizabeth was ordained priest. He held successively many posts at Cambridge, including the mastership of Pembroke Hall and Trinity College, and the regius professorship of divinity.

In 1577 he was appointed Bishop of Worcester, and on the death of Grindal (1583) was raised to the primacy. He had always been a rigid disciplinarian; but he now became an inquisitor, insisted on new articles of subscription, suspended the clergy who refused them, and in every way acted as the intolerant ecclesiastic. He took a leading part in the conference at Hampton Court under James I.—Cf. W. F. Hook, *Lives of the Archbishops of Canterbury*.

WHITGIFT GRAMMAR SCHOOL, Croydon, was founded by John Whitgift in 1596. There is accommodation for over 700 boys.

WHITHORN. A town of Wigtownshire, Scotland, a royal burgh whose present charter dates from 1511 (James V.), but was originally granted by Robert I. (the Bruce). It is especially connected with St. Ninian. Pop. (1931), 951.

St. Ninian, or Ringan, the first apostle of Scotland, died in A.D. 432. His day is 16th Sept. In 397 he founded the *Candida Casa* (or White House), which probably stood on the present Isle of Whithorn. "They say that before that none in Britannia had been constructed of stone. And having first learned that the most holy Martin . . . had passed from earth to heaven, he was careful to dedicate the church itself in his honour" (cf. the *Life* of St. Ailred (Abbot of Rievaulx) in vol. v. of *The Historians of Scotland*). A bishopric of Whithorn founded by the Angles in 727 came to an end in 796, and in the reign of David I. (1124-53) the see of Galloway was established, and a Premonstratensian priory was founded at Whithorn and ultimately became a cathedral. Whithorn was

for long a pilgrimage centre, and the ruins of the cathedral can still be seen.

WHITING (*Gadus merlangus*). A well-known fish belonging to the cod family. It abounds on all the British coasts, and in the seas of Northern Europe generally, and exceeds all the other fishes of its kind in its delicacy and lightness as an article of food. It does not usually exceed 1½ lb. in weight.

WHITLEY BAY. A seaside-resort of Northumberland, England, 2½ miles north-east of Tynemouth. Whitley sands are popular. The town forms part of the urban district of Whitley and Monkseaton, which has a pop. (1931) of 24,210.

WHITLOW. An inflammation of the tissues of the finger liable to extension within the member and into the hand and forearm. A whitlow may be no more than a gathering beneath the cuticle, when fomentation usually suffices for its cure, or it may extend more deeply in the tissues. When the sheath covering a tendon is infected, spread into the hand and wrist is facilitated in the case of the thumb and little finger, the sheaths of which communicate directly with that in the palm. Thus the seat of origin of the trouble in reference to the anatomy of the hand largely determines the extent of spread. For this reason infection of the nail-bed, even if it should involve the bone, does not imply extension so certainly as infection of the tendon sheaths.

In all cases local swelling, pain, and tenderness are present, with formation of pus as the disorder progresses. Constitutional symptoms show themselves, and are severe in proportion to the extent of the inflammatory process. Surgical treatment is called for in all but the least severe forms of whitlow.

WHITMAN, Walt. American poet, born in Long Island, in the state of New York, in 1819, died in 1892. In his early days he worked at carpentry and printing. Subsequently he became a school teacher, and wrote for the press. During the Civil War Whitman devoted himself to the care of the wounded in the hospitals of Virginia and Washington, and at the end of the war came out with his constitution irretrievably broken. He subsequently entered the Government service in the capital, remaining there till 1874. He then removed to Camden, N.J. In 1887 his English admirers raised a subscription in his behalf.

His poems are like nothing else in the language, rough, rude, chaotic even, but strongly individual. The best known are: *Leaves of Grass* and *Drum Taps. Democratic Vistas, Specimen Days and Collect* and *November Boughs* contain his prose writings, old and new, though it is difficult in the case of Whitman to distinguish prose from poetry in the ordinary senses of the terms.

WHITSTABLE. A seaport of Kent, England. It has extensive oyster-fisheries, and there is a small coasting trade. Pop. (1931), 11,201.

WHITTIER, John Greenleaf. American poet, born of Quaker parents in 1807 at Haverhill, Mass., died in 1892. Educated at the academy of his native place, he worked on his father's farm and learned the shoemaking trade, but early began to write for the press. In 1831 he published his first work, *Legends of New England* in prose and verse.

Among the numerous volumes of poetry which he from time to time gave to the world the following may be mentioned: *Moll Pitcher, Lays of my Home, Miscellaneous Poems, The Voices of Freedom, Mabel Martin, Hazel Blossoms, The King's Missive, Poems of Nature, St. Gregory's Guest*, etc. Whittier's poems are distinguished by their freshness, their quiet power, and intense feeling.—Cf. S. T. Pickard, *Life and Letters of John Greenleaf Whittier*.

WHITTLESEA. A town of Cambridgeshire, England. Around it is the land that was formerly Whittlesea Mere, the largest sheet of water in England. Pop. (1931), 8299.

WHITWOOD. An urban district and mining centre of Yorkshire (West Riding), England, on the Calder. Coal-mining is its chief industry. Pop. (1931), 6196.

WHITWORTH, Sir Joseph. English engineer, born in 1803, died in 1887. After working as a journeyman in Manchester and London, he started business in the former city in 1833 as a manufacturer of engineers' tools, thus founding the great firm of which he was long the head. He was known for a system of screw-threads, and also for his standard gauges.

In 1854-5 he began his experiments with fire-arms, which led to the production of the Whitworth gun, and later brought him into competition with Armstrong as a manufacturer of rifled ordnance. He was also the originator of the fluid-pressed steel, used in the manufacture of cannon and ships' plates. His baronetcy was conferred in 1869. He is the author of *Guns and Steel* (1873).

WHITWORTH. A town of Lancashire, England, with cotton-factories, coal-mines, and quarries. Pop. (1931), 8360.

WHITWORTH SCHOLARSHIPS. Scholarships established in 1869 by Sir Joseph Whitworth, to encourage the cultivation of combined theoretical and practical skill in mechanics and engineering. There are six scholarships of an annual value of £125, tenable for three years; and two senior scholarships of an annual value of £250, tenable for two years. Candidates for the scholarships must be under twenty-one years of age, and candidates for the senior scholarships under twenty-six, on the 1st of May in the year in which they compete.

WHORTLEBERRY (Vaccinium). A genus of shrubby plants, the type of the nat. ord. Vacciniaceæ, with alternate leaves, pink or red bell-like flowers, and berries of a dark-purple, bluish, or red colour. The common whortleberry, bilberry, or blaeberry (*V. myrtillus*) is a hardy plant, which grows in forests, heaths, and on elevated mountains. In some of the pine forests of Scotland the plant attains the height of 3 feet. The berries have a pleasant, sweet taste, and are used for making jelly. The berries of the red whortleberry (*V. Vitis-idæa*) are of a bright-red colour, and possess acid and astringent properties; from their similarity to cranberries they are sold as such in various parts of Scotland (*see* CRANBERRY). Whortleberries in North America are generally known as huckleberries.

WHY'DAH. A town of West Africa, in the French colony of Dahomey, on the Bight of Benin. Pop. about 12,000.

WHYDAH-BIRD, or **WIDOW-BIRD.** A name given to weaver-birds of the genus Vidua, inhabiting Western Africa, and found in abundance in the kingdom of Dahomey, near Whydah. In size the whydah-bird resembles a linnet or canary, and during the breeding-season the male possesses long, drooping tail-feathers, giving it a graceful appearance.

WICH'ITA. A city of Kansas, United States, the county seat of Sedgwick county, on Arkansas River. It is the most important railway centre in the state, and carries on slaughtering and meat-packing. Settled in 1870, it became a city in 1871. Pop. (1930), 111,110.

WICK. A royal burgh and seaport of Scotland, capital of the county of Caithness, at the head of the Bay of Wick, and on the River Wick, over which is a bridge connecting it with its suburb, Pulteney-Town. From here steamers go to the Orkney and Shetland Islands. Nearby are the relics of Wick Castle, called the Old Man of Wick. The staple employment is herring-fishing. Pop. (1931), 7548.

WICKHAM MARKET. A village of Suffolk, 12½ miles from Ipswich and 81¾ from London. It stands on the river Deben and has some interesting old buildings. Pop. (1931), 1259.

WICKHAM, WEST. A village of Kent, near the borders of Surrey, 4 miles from Croydon, Hayes Place, the seat of the Earl of Chatham. It was the birthplace of William Pitt in 1759.

WICKLOW. A maritime county, Leinster, Irish Free State; area, 500,204 acres. The coast is mostly precipitous, and dangerous from sandbanks. The surface is diversified and picturesque, rising into the Wicklow Mountains, the loftiest of which is Lugnaquilla (3039 feet altitude). Its minerals include a little gold in the streams, lead and copper ores, and pyrites in considerable quantities. The principal rivers are the Slaney, Vartrey, and Avoca. Bray, Arklow, Wicklow, and Baltinglass are the chief towns. Pop. (1926), 57,591.

WICKLOW. County town of Wicklow, Irish Free State, a seaside-resort, with chemical-works and exports of cereals. Pop. (1926), 3027.

WIDDIN, or **VIDIN.** A town of Bulgaria, on the right bank of the Danube. There is a considerable trade, chiefly in corn, wine, and salt. Pop. (1926), 18,507.

WIDGEON, or **WIGEON.** A species of aquatic bird belonging to the Anatidæ or duck family; the *Mareca penelŏpe*. It breeds occasionally in the most northern parts of Scotland, but the ordinary breeding-place is in more northern regions. They are numerous in the British Islands during the winter, and are in request for the table. The American widgeon is the *M. americāna*. It is most abundant in Carolina.

WIDNES. A municipal borough of Lancashire, England, on the Mersey (here crossed by a "transporter" bridge to Runcorn and a railway bridge). There are extensive chemical-works; copper-smelting works, rolling-mills, iron-foundries, etc. Pop. (1931), 40,608.

WIELAND, Christoph Martin. German epic poet, born in 1733, died in 1813. He was educated at the University of Tübingen, and was appointed professor of philosophy in 1769 at Erfurt. The early period of his literary life was devoted to pietistic or at least serious poetry, such as *The Nature of Things* (1752), *Twelve Moral Letters in Verse, Anti-Ovid* (1752), and *The Trial of Abra-*

ham's Faith (1753); in the second period he produced the romances *Agathon* (1766) and *Don Sylvio de Rosalva* (1764), the poem *Musarion* (1768), and a prose translation of Shakespeare in eight vols. (1762-6); while in the third and ripest period were written the romantic epic of *Oberon* (1781), *History of the Abderites* (1871), *The Republic of Fools*, London, 1861), *The Secret History of Peregrinus Proteus* (1791), etc.

WIELICZKA (vyel-ich'kâ). A town of Poland, Galicia, situated 8 miles south-east of Cracow, and noted for its extensive salt-mines. Pop. 6000.

WIENER-NEUSTADT. A town of Austria, 25 miles south of Vienna. It was almost entirely destroyed by fire in 1834, but a number of interesting mediæval buildings yet remain. There are important manufactures of locomotives, machinery, pottery, leather, etc. Pop. 36,956.

WIESBADEN. A town of Prussia, in the province of Hesse-Nassau, finely situated at the foot of Mount Taunus, in the valley of the Salzbach, about 2 miles from the Rhine. It is noted for its hot medicinal saline springs, the temperature of the Kochbrunnen being 156° F. Wiesbaden is the *Mattiacum* of the Romans, and its waters (*aquæ Mattiacæ*) were known to Pliny (*Hist. Nat.*, xxi., 2). The city has a trade in wine. Pop. (1925), 151,961.

WIG'AN. A borough of Lancashire, England, on the Douglas. It stands in the centre of an extensive coalfield, and its manufactures consist chiefly of calicoes, fustians, checks, and other cotton goods, cotton twist, and linens. There are iron-foundries, iron-forges, railway-wagon works, iron-rolling mills, large breweries, chemical-works, and corn- and paper-mills. Pop. (1931), 85,357.

WIGHT, ISLE OF. An island off the south coast of England, in the county of Hants, separated from the mainland by Spithead and the Solent; 23 miles in length, 13 miles broad; area, 94,146 acres. The main slope of the island is to the north, as is shown by the course of its chief streams, the Medina, Yar, and Eastern Yar. A range of chalk downs, which cross the island from east to west and form excellent sheep-walks, separate it into two districts somewhat different in character.

The general appearance is picturesque, and the geology of the island is interesting. The air is mild, and the district known as the Undercliff, lying along the south coast, and completely sheltered from the north, has long been a resort for invalids.

The chief towns are Newport (the capital), Ryde, Cowes, Ventnor, Bembridge, Freshwater, Yarmouth, and the fashionable health-resorts of Sandown and Shanklin. Near Cowes is Osborne House (q.v.), once a residence of Queen Victoria. Carisbrooke Castle is an interesting ruin. Pop. (1931), 88,400.

WIGTON. A town of Cumberland, England. Tanning and brewing are among its industries. Near was the Roman station of old Carlisle. Pop. (1931), 3521.

WIGTOWN. A royal burgh and seaport of Scotland, the county town of Wigtownshire, on the west side of Wigtown Bay. It has a memorial to two martyrs, women who were drowned in the Solway because they were Covenanters. Pop. (1931), 1261.

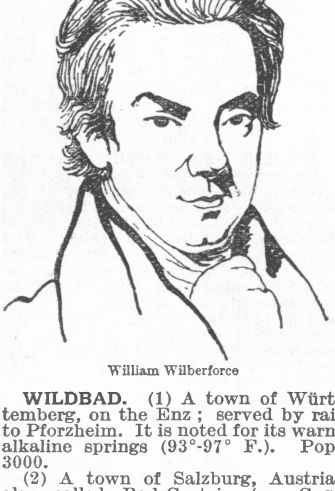
WIGTOWNSHIRE. A county of Scotland, occupying the south-western extremity of the kingdom, and forming the western division of Galloway; area, 311,984 acres. The coast is indented by deep and spacious bays, of which Wigtown Bay, Luce Bay, and Loch Ryan are the most important. The chief river is the Cree, which is partially navigable.

Except in the peninsular portions (Rhinns of Galloway), the surface is better adapted for pasture than tillage, and a good deal of it is of poor quality. Pop. (1931), 29,299. Stranraer is the largest town; others are Wigtown (county town), Port-Patrick, and Newton Stewart.

WILBERFORCE, Samuel. English prelate, son of William Wilberforce, the philanthropist; born in 1805, died in 1873. He graduated at Oriel College, Oxford; was appointed curate of Checkendon (1828), rector of Brightstone in the Isle of Wight (1830); became a rural dean (1836), Canon of Winchester (1840), Brampton lecturer (1841), Dean of Westminster (1845), and in the same year Bishop of Oxford. He was the leader of the High Church party, and the author of numerous works. In 1869 he was translated to the see of Winchester.

WILBERFORCE, William. English statesman and philanthropist; born 1759, died 1833. After completing his education at St. John's College, Cambridge, he was, in 1780, elected member of Parliament for his native town; and in 1784 he was returned by the county of York. In 1786 he made the acquaintance of Clarkson, who gained his sympathies on behalf of the agitation against the slave-trade.

In 1791 he moved for leave to bring in a Bill to prevent further importation of African negroes into the British colonies. Year after year he pressed this measure, but was always defeated till 1807, when it was passed during the short administration of Fox. He then devoted his energies to bringing about the total abolition of slavery, and three days before his death he was informed that the House of Commons had passed a Bill which extinguished slavery in the British colonies.



William Wilberforce

WILDBAD. (1) A town of Württemberg, on the Enz; served by rail to Pforzheim. It is noted for its warm alkaline springs (93°-97° F.). Pop. 3000.

(2) A town of Salzburg, Austria, also called Bad-Gastein (*see* GASTEIN).

(3) Wildbad-Kreuth, a town of Bavaria, near the Tegernsee, on the Weissach, and among the Bavarian Alps at an altitude of about 2624 feet. The mineral springs have been known since the fourteenth century, and are visited by about a thousand persons annually. Pop. 200 to 300.

(4) Wildbad-Trarbach or Bad Wildstein; mineral springs (95° F.) are located near Traben-Trarbach, a town of Rhineland, Prussia, on the Moselle; a junction on the railway from Pünderich for the Trier-Bullay line. The town comprises Traben, on the left bank of the Moselle, and Trarbach, on the right bank. Pop. 9000.

WILD BIRDS' PROTECTION. By a British Act of Parliament passed in 1880 all wild birds are protected between 1st March and 1st August, and it is prohibited to kill or take certain of them mentioned in a schedule to the Act under a penalty of not more than £1 per bird, the others under a penalty of reprimand and cost in the first instance, but for every subsequent offence 5*s.* for each bird and costs in addition. By subsequent Acts county councils may protect any wild birds and their eggs, and by the Protection of Birds Act, 1925, certain methods of capturing wild birds and of keeping birds in inadequate cages are prohibited.

WILDE, Oscar Fingal O'Flahertie Wills. Irish writer and æsthete; born in Dublin in 1854, and died in Paris in 1900. His father was a celebrated surgeon, and his mother an erratic literary woman who had a literary *salon* and wrote under the name of "Speranza." Wilde was educated at Portora Royal School, Trinity College, Dublin, where he won the Berkeley gold medal, and Magdalen College, Oxford, where he took a first class both in Moderations and Literæ Humaniores, and won the Newdigate prize.

He soon became a leader in the æsthetic movement, and was caricatured by *Punch*, and ridiculed by Gilbert as Archibald Grosvenor in the Gilbert and Sullivan opera *Patience*. He lectured in America on the æsthetic movement, but was engaged to do so in order to make *Patience* intelligible rather than to propagate his own gospel of art.

His first volume of poems appeared in 1881. He wrote for several magazines and reviews, and for two years edited *The Woman's World*. In 1887 he published *Lord Arthur Savile's Crime* and *The Canterville Ghost*. In 1888 he published *The Happy Prince and other Tales*. His other works include: *The Portrait of Mr. W. H.* (*see* SHAKESPEARE), *The Picture of Dorian Gray* (1890), and his plays *Salomé*, *Lady Windermere's Fan*, *A Woman of no Importance*, *An Ideal Husband*, and *The Importance of Being Earnest*.

In 1895 Wilde brought an action for criminal libel against the eighth Marquess of Queensberry. He lost his case, and was himself charged with offences under the Criminal Law Amendment Act, and sentenced to two years' imprisonment with hard labour. In prison he wrote *The Ballad of Reading Gaol*. After his release he lived in France, broken in health and reputation. Part of his *apologia* was published in 1905 under the title of *De Profundis*. The rest is not to be published until 1960.

The tragedy of Wilde's life was a

matter for the pathologist rather than for the judge, and should arouse pity rather than disgust. His writings are all superficially clever, overladen with paradox and epigram. His conversation was more striking than any of his poems, essays, or plays.

WILHELMINA. Queen of the Netherlands. She was born at the Hague, 31st Aug., 1880, the only child of William III. by his second marriage. She succeeded to the throne, 23rd Nov., 1890. She married on 7th Feb., 1901, Henry Wladimir Albert Ernst, Duke of Mecklenburg-Schwerin. On 30th April, 1909, she gave birth to a daughter, Princess Juliana.

WILHELMSHAVEN. A detached town and port of the Prussian province of Hanover, an enclave of Oldenburg, on Jade Bay; served by rail to Oldenburg. It is the former imperial war-harbour, and is named after Kaiser Wilhelm I., during whose reign the Prussian navy was founded (1849) and the Wilhelmshaven territory (4 sq. miles) acquired by purchase from Oldenburg (1859). After the European War the port was demilitarised. Pop. 25,403.

WILKES, John. British politician; born 1727, died 1797. He was the son of a rich distiller, and was educated for some time at Leyden. Returned to Parliament as member for Aylesbury (1757), he attained considerable notoriety by the publication of a paper entitled *The North Briton*, in No. 45 of which (1763) he commented severely on the king's speech to Parliament. The Home Secretary in consequence issued a general warrant, upon which Wilkes, with others, was apprehended and committed to the Tower, but released by Chief Justice Pratt, who declared the prosecution illegal. On the next meeting of Parliament, however, a special law was passed to sanction his prosecution, and in 1764 he was expelled from the House of Commons.

As he had by this time withdrawn to France and did not appear to receive sentence, he was outlawed. He returned, however, to England at the election of 1768, and was sent to Parliament as representative of Middlesex, but was expelled from the House and committed to prison. Three times after this he was re-elected within a few months by the same constituency, but the House of Commons persisted in keeping him out, giving rise to a formidable agitation in favour of "Wilkes and liberty."

He was released from prison in 1770, having been elected alderman of London, and he was next appointed sheriff of Middlesex, L Mayor of London, and again (17 member of Parliament for Middles On this occasion he was allowed take his seat, and in 1782 the reso tions respecting the disputed Midd sex election were expunged from t journals of the House of Commo He published many speeches a pamphlets, and two collections of correspondence were published aft his death.—Cf. P. H. Fitzgerald, *T Life and Times of John Wilkes.*

WILKESBARRE. A city of Pen sylvania, United States, the coun seat of Luzerne county, on the nor branch of the Susquehanna; serv by the Lehigh Valley, Pennsylvani and other railways. It is the cent of a rich anthracite coal-field, a has manufactures of machinery, loc motives, cars, mining engines a tools, iron castings, ropes, brewe products, cutlery, lace, etc. Settle in 1769, it became a city in 187 Pop. (1930), 86,626.

WILKIE, Sir David. Scottis painter; born 1785, died 1841. H received his early art training at th Trustees' Academy, Edinburgh entered the schools of the Roya Academy, London, in 1805; firs exhibited there (1806) *The Villag Politicians*, which at once estab lished his reputation; was elected a associate of the Academy in 1809 and in 1811 became an Academician

In 1825, owing to ill-health, h made an extended tour through Italy Germany, and Spain. In the latte country his style as a painter under went a marked change when he came under the influence of Velasquez and Murillo. Returning after three years to England, he was appointed (1830) painter in ordinary to the king, and was knighted in 1836. His pictures, such as *The Blind Fiddler, Rent Day, Cut Finger, Rabbit on the Wall, Penny Wedding, Cottar's Saturday Night*, etc., are well known as engravings. These belong for the most part to his early and best period, when his method was characterised by subdued colouring and minute and spirited drawing.

His later and less successful style is distinguishable by a breadth of treatment which sometimes shows looseness in drawing, and deals chiefly with historical subjects. It is represented by *The Entrance of George IV. into Holyrood, The Spanish Council of War, The Maid of Saragossa, Napoleon and Pius VII.*, and *The Queen's First Council.*—Cf. Allan Cunningham, *The Life of Sir David Wilkie.*

WILLEMSTAD. A town of the Netherlands West Indies, capital of

the colony of Curaçao. It is a port, and has considerable trade. Pop. about 15,703.—There is a Willemstad in North-Brabant, Netherlands. Pop. 3000.

WILLENHALL. A town of England, in West Staffordshire. There are brass- and iron-foundries, but the staple industry is in locks and padlocks. Pop. (1931), 21,147.

WILLESDEN. A parish and urban district in Middlesex, a suburb of London, 7 miles north-west of St. Paul's. It is an important railway junction, and has an old church. Pop. (1931), 184,410.

WILLET. A bird of the plover family found in temperate America. Called also *stone curlew*.

WILLIAM I. Surnamed *the Conqueror*, King of England and Duke of Normandy; born 1027, died at Rouen 9th Sept., 1087. He was the natural son of Robert, Duke of Normandy, by Arlotta, the daughter of a tanner of Falaise. His father having no legitimate son, William became the heir at his death, and ruled Normandy with great vigour and ability.

The opportunity of gaining a wider dominion presented itself on the death of his second cousin, Edward the Confessor, King of England, whose crown he claimed. To enforce this claim he invaded England, and the victory of Hastings, in which his rival, Harold, was killed, ensured his success (1066).

He then established the administration of law and justice on a firm basis throughout England, conferred numerous grants of land on his own followers, and introduced the feudal constitution of Normandy in regard to tenure and services. He also expelled numbers of the English Church dignitaries and replaced them by Normans. Towards the end of his reign he instituted that general survey of the landed property of the kingdom, the record of which still exists under the title of *Domesday Book*.

In 1087 he went to war with France, whose king had encouraged a rebellion of Norman nobles. He entered the French territory, and committed great ravages, but when he burnt Mantes, his horse trod on a hot cinder and stumbled, and he was thrown forward in his saddle and received an internal injury which caused his death at the abbey of St. Gervais, near Rouen.—BIBLIOGRAPHY: E. A. Freeman, *William the Conqueror*; *History of the Norman Conquest*; Sir P. Vinogradoff, *English Society in the Eleventh Century*.

WILLIAM II. Surnamed *Rufus*, from his ruddy complexion, third son of the preceding; born in Normandy in 1056, died in 1100. Nominated by his father to the English succession in preference to his elder brother Robert, he was crowned at Westminster in 1087. The Norman barons, however, were discontented, and sought to make Robert King of England, but this project was defeated by William, who secured the aid of Lanfranc, Archbishop of Canterbury, and the English nobles.

A characteristic incident in William's reign was his contention with Anselm, Archbishop of Canterbury, regarding Church property and the sovereignty of the Pope. He met his death while hunting in the New Forest, by an arrow shot accidentally or otherwise from the bow of a French gentleman named Walter Tyrrel.—Cf. E. A. Freeman, *William Rufus*.

WILLIAM III. Stadtholder of Holland and King of England, son of William II. of Nassau, Prince of Orange, and Henrietta Mary Stewart, daughter of Charles I. of England; was born at The Hague on the 4th Nov., 1650, died 8th March, 1702.

During his early life all power was in the hands of the grand pensionary, John De Witt, but when France and England in 1672 declared war against the Netherlands, there was a popular revolt, in which Cornelius and John De Witt were murdered, while William was declared captain-general, grand-admiral, and stadtholder of the United Provinces. In the campaign which followed he opened the sluices in the dykes and inundated the country round Amsterdam, thus causing the French to retire, while peace was soon made with England.

In subsequent campaigns he lost the battles of Seneffe (1674) and St. Omer (1677), but was still able to keep the enemy in check. In 1677 he was married, and the Peace of Nijmegen followed in 1678. For some years subsequent to this the policy of William was directed to curbing the power of Louis XIV., and to this end he brought about the League of Augsburg in 1686. As his wife was heir presumptive to the English throne, he had kept close watch upon the policy of his father-in-law, James II., and in 1688 he issued a declaration recapitulating the unconstitutional acts of the English king, and promising to secure a free Parliament to the people.

Being invited over to England by some of the leading men, he arrived suddenly at Torbay (5th Nov., 1688) with a fleet of 500 sail, and with

14,000 troops. Upon landing, a great part of the nobility declared in his favour, and in December James fled with his family to France, after which William made his entry into London. The throne was now declared vacant, the Declaration of Rights was passed, and on 13th Feb., 1689, Mary was proclaimed queen and William king.

Scotland soon afterwards followed England's example (with a partial resistance under Dundee); but in Ireland, whither Louis XIV. sent James with an army, the majority of the Catholics maintained the cause of the deposed king, until they were defeated at the Boyne (1690) and at Aughrim (1691). In the war with France William was less successful; but although he was defeated at Steinkirk (1692) and Neerwinden (1693), Louis was finally compelled to acknowledge him King of England at the Peace of Ryswick in 1697.

In 1701 James II. died, and Louis XIV. acknowledged his son as King of England. England, Holland, and the Empire already combined against Louis, and the War of the Spanish Succession was just on the point of commencing when William died from the effects of a fall from his horse.—Cf. E. S. and M. S. Grew, *The Court of William III.*

WILLIAM IV. King of Great Britain and Ireland, and third son of George III.; born 1765, died 1837. He served in the navy, rising successively to all the grades of naval command, till in 1801 he was made Admiral of the Fleet. In 1789 he had received the title of Duke of Clarence, and in June 1830, he succeeded his brother, George IV., as king.

The great events which render his reign memorable are the passage of the Reform Act, the abolition of slavery in the colonies, and the reform of the poor-laws. He married (1818) Adelaide, sister of the Duke of Saxe-Meiningen, by whom he had no surviving children, but by his connection with Mrs. Jordan, the actress, he had a large family.—Cf. P. H. Fitzgerald, *The Life and Times of William IV.*

WILLIAM I. German Emperor, and seventh King of Prussia, second son of Frederick William III.; born 22nd March, 1797, died 9th March, 1888. He married in 1829 Princess Augusta of Saxe-Weimar; became heir presumptive to the throne of Prussia on his father's death in 1840; was commander of the forces which suppressed the revolutionary movement (1849) in Baden; created regent in 1858, and on the death of the king, his brother, in 1861 he succeeded to the throne of Prussia. In 1871 he took the title of Kaiser, which was also used by his successors.

During his reign Prussia defeated Denmark (1864), annexing the Duchies of Schleswig-Holstein; quarrelled with Austria, and engaged in a campaign which ended in the victory of Sadowa (1866); and went with the rest of Germany to war with France in 1870. In this war the operations of the Prussian generals were under the personal supervision of the king. It was at Versailles, during the siege of Paris (18th Jan., 1871), that he was proclaimed German Emperor.

WILLIAM II., Friedrich Wilhelm Victor Albert. Formerly German Emperor (Kaiser) and King of Prussia, son of Frederick III. and Victoria, daughter of Queen Victoria; born at Berlin, 27th Jan., 1859. Educated at Cassel and Bonn, he studied law and political science. In 1881 he married Augusta Victoria, daughter of the Duke of Augustenburg.

He succeeded his father on 15th June, 1888, and very soon gave evidence of self-assertiveness and a restless mind. Throughout his reign he steadily strove to establish a personal rule, untrammelled by ministerial control. He dismissed Prince Bismarck in 1890, and subsequently to all intents and purposes ruled himself, his chancellors being merely his tools. He decided to obtain for Germany "a place in the sun," and encouraged German colonial expansion.

Having declared that Germany's future lay on the water, he built a powerful navy. Although he frequently pretended that he was anxious for peace, he decided on war in 1914, when he thought that the German army was invincible (*see* EUROPEAN WAR). Germany having been beaten, he was compelled to abdicate on 9th Nov., 1918, and fled to Amerongen, in Holland. His wife died on 11th April, 1921, and he married again in 1922. *See* GERMANY.

WILLIAM THE SILENT, Count of Nassau and Prince of Orange. Eldest son of William, Count of Nassau; born in 1533, died in 1584. He had large estates in the Netherlands, and held high offices under Charles V. and his son, Philip II.; but the reckless persecution of the Protestants roused him against the Spaniards, and when the Duke of Alva with a Spanish force was sent to subdue the Netherlands (1567) he retired to Germany.

Although educated in the Roman Catholic faith, he declared himself a Protestant, and personally led an army into Brabant against Alva, but

illed to bring about an engagement. n 1572 the Estates appointed the rince stadtholder of Holland, Zeaand, Friesland, and Utrecht, with ower to prosecute the war against pain. He acted as leader of the evolt until his death, and it was by is political prudence that the five orthern provinces joined in the Union of Utrecht (1579), and thus aid the foundations of the Republic f the United Netherlands.

To check this growing power Philip et a price of 25,000 gold crowns pon the head of the prince, with the esult that his life was attempted in 582 at Antwerp, and he was ultimately assassinated at Delft by a fanatic named Balthasar Gerard.

WILLIAMSPORT. A city of Pennsylvania, United States, the county seat of Lycoming county, on the west branch of the Susquehanna; served by the Pennsylvania and other railways. It is a favourite summer residence, and the centre of a large lumber trade. Settled in 1795, it became a city in 1866. Pop. (1930), 45,729.

WILLIAMSTOWN. A seaport of Victoria, Australia, on the southwest shore of Hobson's Bay, immediately opposite Sandridge (Port Melbourne), and 9 miles by rail from Melbourne. The piers are commodious, and there are ship-building yards, patent slips, the Alfred Graving Dock, Government workshops, and canning factories. Pop. 18,000.

WILLIMANTIC. A town of the United States, in Windham county, Connecticut, an important railroad and industrial centre. Pop. (1930), 12,100.

WILLOW. The common name of different species of plants belonging to the genus Salix, the type of the nat. ord. Salicaceæ. The species of willows are numerous, about 160 having been described, many of which are British. They are all either trees or bushes, and grow naturally in a moist soil.

The Huntingdon or white willow (*Salix alba*) and the Bedford willow (*S. Russelliana*) are large trees, yielding a light soft timber, valuable for resisting the influence of moisture or damp. The weeping willow (*S. babylonica*) is a native of China, and is a fine ornamental tree.

WILLOW-GROUSE. *See* PTARMIGAN.

WILLOW-MOTH. A species of mouse-coloured moth (*Caradrina cubicularis*), the hinder wings of which are pure white. The larvæ feed on grains of wheat, often doing much damage in ricks.

WILLOW-WREN (*Phylloscopus trochilus*). One of the most abundant of the warblers, and a summer visitant in Britain, with a pleasing song. The general colour is dull, olive-green above, the chin, throat, and breast yellowish-white, and the belly pure white.

WILMINGTON. A city of Delaware, United States, near the Delaware between Brandywine and Christiana Creeks. It is regularly built, and has a Government building, city hall, court-house, shipyards, cotton-factories, iron-foundries, rolling-mills, potteries, tanneries, powder-works, and an extensive trade. Pop. (1930), 106,597.

WILMINGTON. A city and port of entry of North Carolina, United States, the county seat of New Hanover county, on Cape Fear River; served by the Seaboard Air and Atlantic Coast Railways. It is the largest town in the state, has turpentine-distilleries, machine-shops, etc., and exports large quantities of cotton and lumber. Pop. (1930), 32,270.

WILSON, Sir Henry Hughes. British soldier; born in 1864, and died in 1922. He was educated at Marlborough, and entered the army in 1884. After serving a few months with the Royal Irish Regiment, he transferred to the Rifle Brigade. He took part in the Burma expedition (1886-8), and in South Africa (1899-1901). From 1901 to 1906 he was employed at the War Office; from 1907 to 1910 he was commandant of the Staff College; and from 1910 to 1914 he was Director of Military Operations at the War Office.

He was in close touch with the French army, and did much to facilitate co-operation between the French and the British during the European War. He became Deputy-Chief of the General Staff at the outbreak of war; and was in turn principal liaison officer, commander of the 4th Corps, British Military Representative on the Supreme War Council at Versailles, and (1918) Chief of the Imperial General Staff.

He played a prominent part in the victorious campaign which ended the war, and in 1919 was promoted field-marshal, created a baronet, and given a grant of £10,000. In Dec., 1921, he resigned his position at the War Office, and was elected member of Parliament for North Down in Feb., 1922.

He gave the Government of Northern Ireland expert advice on the measures necessary to maintain order within its area.

Sir Henry Wilson was murdered

on 22nd June, 1922, outside his house in Eaton Place, by two supporters of the Irish Republic. Sir Henry was a man of wide culture, as well as of a fearless disposition.

WILSON, Thomas Woodrow. Twenty-eighth President of the United States; born in 1856. Educated at Princeton, he published (1885) his thesis *Congressional Government: a Study of Government by Committee*, which achieved an immediate success. In 1890 he was appointed professor of jurisprudence and political economy at Princeton, and elected president in 1902.

A Democrat in politics, he was nominated Governor of New Jersey in 1910, and during his governorship became known as an able politician and progressive statesman. The Democratic party now nominated him for President of the United States, and he was elected by a large majority in 1912. Two of his acts in foreign policy were the refusal of his Government to recognise Huerta as President of Mexico, and the recognition of the Chinese Republic.

At the beginning of the European War President Wilson was in favour of strict neutrality as far as the United States was concerned, and opposed demands for greater military preparedness. On 4th Aug., 1914, he sent an offer of mediation to Britain, France, Russia, and Germany, and made several other unsuccessful attempts at mediation.

Wilson was elected to a second term of office in Nov., 1916, the unsuccessful candidate being Charles Evans Hughes, ex-Governor of New York. By this time his hopes that the United States could maintain an armed neutrality proved vain, especially in view of the methods adopted by Germany in her submarine warfare.

On 2nd April, 1917, therefore, he summoned an Extraordinary Session of Congress, and made the proposal that the United States should declare war against Germany. On 8th Jan., 1918, in an address to Congress, he defined his programme for the world's peace in his famous "fourteen points," in the last of which he urged the formation of a League of Nations (q.v.).

When the Armistice was concluded, Wilson sailed for France, and on 14th Dec., 1918, arrived in Paris. His task at the Peace Conference was not an easy one, and he certainly did not succeed in making the Allied Powers adopt *all* his fourteen points. As he had set his heart upon fashioning a League of Nations, he had to make repeated concessions in order to enlist the sympathy and support of his associates. In the meantime his healt had given way, and, when the Treat of Versailles was at last signed, h returned to the United States.

At home he encountered stron opposition from the Republican ma jority of the Senate, who bitterl criticised the terms of peace an objected to the Covenant of th League of Nations, and, under th severe strain, his health broke down and he retired into private life i March, 1921. He died 3rd Feb., 1924

Woodrow Wilson

His works include: *Division and Reunion, 1829-89* (1893 and 1909); *A History of the American People* (1902); *Constitutional Government in the United States* (1908); *On Being Human* (1916); *International Ideals* (1919); and *The Hope of the World* (1920).—BIBLIOGRAPHY: H. J. Ford, *Woodrow Wilson: the Man and his Work*; H. Wilson Harris, *President Wilson: his Problems and Policy*; D. Halévy, *President Wilson*; C. Sheridan Jones, *President Wilson: the Man and his Message.*

WILTON. A borough of Wiltshire, England. It has an ornate Romanesque church, and is famous for carpets. Wilton House, designed by Inigo Jones, is the ancient seat of the Earls of Pembroke. The house is memorable for its associations with Shakespeare and Sidney. Pop. (1931), 2193.

WILTS, or WILTSHIRE. A south-western county of England, bounded by the counties of Gloucester, Somerset, Dorset, Hants, and Berks; area, 860,829 acres. It is of a compact and nearly quadrangular form, and is divided by the Upper Avon and Kennet, and the canal between them, into north and south divisions. The north is flat and fertile, and includes Marlborough Downs, upon which is the stone circle of Avebury, while in the south division is Salisbury Plain, an elevated table-land, for the most part unenclosed and uncultivated, on which are the remains of Stonehenge, about 9 miles north of Salisbury. The strata of the county are principally cretaceous, belonging to the great central chalk district of England; and the chief rivers are the Kennet, and the Upper and Lower Avon.

The larger proportion of the surface is in pasture, devoted chiefly in the south division to the rearing of sheep, and in the north to cattle-grazing and dairying. Wiltshire bacon and cheese are famous.

Manufactures comprise woollen goods, for which the principal localities are Wilton, Bradford, Trowbridge, and Westbury, excellent cutlery and steel goods at Salisbury, ropes and sacking at Marlborough, iron-founding at Devizes, and there are great railway works at Swindon, the largest town. Salisbury is the county town. Pop. (1931), 303,258.

WIMBLEDON. A municipal borough of Surrey, England, 7 miles south-west of London, at the north-east extremity of Wimbledon Common. It is famous for its lawn tennis ground, the headquarters of the game, where, in June, the championship matches are played. Pop. (1931), 59,520.

WINCEY. A strong and durable union cloth, plain or twilled, often composed of a cotton warp and a woollen weft. Heavy winceys have been much worn as skirtings and shirtings. The name is probably a contraction of linsey-woolsey, which would doubtless be made from flax yarns and wool yarns originally.

WINCH. The windlass used to lift water from a well is a simple barrel winch. To obtain greater mechanical advantage, a gear-wheel is placed on the drum of a winch, and a pinion on the shaft of the turning-handle. The addition of other trains or wheels gives further advantage. Band brakes are commonly fitted to prevent running back. Electrical- and steam-driven winches are used for weighing anchor and for lifting the heavy loads of ships' cargoes and on such devices as jib cranes.

WINCHESTER. An ancient city of Hampshire, England, on the Itchen. The most important edifice is the cathedral, originally built in the latter half of the eleventh century. It is in the form of a cross; length from east to west, 545 feet; width of the transepts, 208 feet. Besides being in itself of great architectural importance, it contains numerous monuments of historical interest: as the tombs of William Rufus, of Edmund, son of King Alfred, and of Izaak Walton; the golden shrine of St. Swithin; bronze figures of James I. and Charles I., etc.

The other important buildings and institutions are: St. Mary's College or Winchester College, founded by William of Wykeham in 1387, the oldest of the English public schools; the castle; Victoria Hospital; barracks; and the Hospital of St. Cross, founded in 1132. Pop. (1931), 22,969.

Winchester was the capital of Wessex (q.v.), and when the kings of Wessex became kings of all England, it became the capital of England. Its importance declined after Normandy was wrested from King John (1203).

WIND. Air in motion. Winds are classified as constant, periodical, and variable.

Constant Winds. The most general features of the atmospheric circulation are yet far from completely understood. The salient fact is a rarefaction and rising of the air over the heated equatorial regions. Winds are drawn in from both hemispheres to supply its place, and these, being diverted in a westerly direction by the earth's rotation, form the north-east and south-east trade winds, an example of constant winds. They blow from near the calms of Cancer and Capricorn, the situations of which are called the Horse Latitudes, about 30° north and south latitude. The rising equatorial air flows in the higher atmosphere as return currents above and opposite to the lower trade winds. At the Horse Latitudes it descends, partly to return as the trade winds and partly to travel as a surface wind to higher latitudes. The latter part forms our prevailing south-westerly winds, and the more persistent north-west winds of the "roaring forties" (latitudes 40° to 49° S.).

Periodical Winds. The circulation described above is subject to great interruption over the continental masses. In the northern winter months Central Asia becomes extremely cold and a centre of high

pressure. This causes an outflow of wind over Southern Asia from the north-east. In the northern summer the same region is extremely warm, with low pressure. South-west winds then blow over the northern Indian Ocean. This is an example of periodical winds—the north-east and south-west *monsoons*.

Land and Sea Breezes. The air over the land is colder during the night than the air over the sea. There is therefore a flow of air from sea to land in the upper regions of the atmosphere, so that pressure rises over the land, and the air at lower levels flows seawards. This is the "land breeze." During the day a similar process with reversed conditions gives rise to the "sea breeze."—Cf. A. E. M. Geddes, *Meteorology*.

WINDAU (Lett. *Ventspils*). A seaport of Latvia. Pop. 25,000.

WINDERMERE. The largest sheet of water in England, and renowned on account of the beauty of its scenery; partly in Westmorland and partly in Lancashire. It is 10½ miles long, and averages 1 mile in breadth.

WINDHAM, William. English statesman, born 1750, died 1810. After being educated at Eton, Glasgow, and Oxford, he was returned to Parliament (1784) as member for Norwich. He became Secretary of War in 1794, and remained in this position until the retirement of Pitt in 1801; took office again in the Grenville administration (1806), and brought forward a Bill to limit the term of service in the army, as also to increase the pay and pensions of officers and men; retired from office (1807), and strenuously opposed the Copenhagen and Walcheren expeditions.

WINDHOEK. A town of the Territory of South-West Africa, the administrative centre and formerly the capital of German South-West Africa. At an altitude of 5456 feet, it has a mean annual temperature of 67° F. (January, 74·5°; June, 56° F.) and a rainfall of 15 inches. Grootfontein (5020 feet altitude) has a mean rainfall of 24 inches. January is the rainiest month in both places. Klein Windhoek, a German colonial settlement, is noted for its five hot springs. Most of the houses have hot water laid on from the springs. The population is 17,408, 4602 of whom are white.

WIND-INSTRUMENTS. It is customary to confine the term wind-instrument to those which are sounded by the breath of the performer. Though the earliest of musical discoveries, wind-instruments as used in the military bands and symphony orchestras of to-day are less than a century old.

The difficulties to be overcome in connection with their development arose from the fact that the vibrating column of air, which is in every case the medium of sound production, does not of itself give a continuous series of sounds according to any scale, but can provide only the sounds of the harmonic series, or "chord of nature." No instrument which could produce these notes alone can be of any but a strictly limited use in music, and the disadvantage is increased by the fact that some of the notes are slightly out of tune with the corresponding sounds of the accepted scale-systems.

It must be remembered that every note in music has its own harmonic series, exactly corresponding to that given for C. This fact, combined with the other equally important fact that any instrument can be made to yield another note of its own by altering the length of the vibrating column of air, furnished the ultimate solution of the difficulty of providing an unbroken scale in wind-instruments.

The most usual and most practical method of classifying wind-instruments is according to the manner in which the column of air is made to vibrate by the lips of the player. This method yields three great classes, those of flute, reed, and brass.

Flute Instruments. Instruments of the flute class are composed of an open cylindrical tube, or a series of them, as in the case of Pan's pipes, and the air column is made to vibrate by blowing across the end as in Pan's pipes, by blowing through a slit at the top, as in the ancient recorder and in the penny whistle, or sideways across a mouth-hole, as in the orchestral flute.

The length of the vibrating column is varied by opening with the lifted finger, or some more or less elaborate mechanism, a series of holes placed laterally in the tube at carefully calculated intervals.

The natural scale of the instrument is limited to one octave, but by blowing slightly harder and altering the angle of the stream of air from the player's lips the pitch of the instrument leaps an octave higher, and a further application of the same means alters the pitch yet another octave.

Reed-instruments are of four classes, those with single reed and cylindrical tube (clarinets), single reed and conical tube (saxophones), double reed and cylindrical tube (no examples in modern use), and double reed and conical tube (oboe, cor anglais, and bassoon). The reeds in these instruments are directly controlled by the

player's lips, the principles of sound production being otherwise the same as in instruments of the flute class, excepting that all members of the clarinet family " overblow " a twelfth and not an octave.

In **brass instruments** the length of the tube plays an important part, a short tube giving more readily the lower harmonics of the natural series (bugle, post-horn), while the upper harmonics, which it will be noticed are much closer together than the lower ones and therefore more generally approximating to a musical scale, are more easily produced from a long tube (trumpet, French horn). For an example of valve action and its functions in connection with these instruments, *see* TRUMPET.

In the trombone, and less commonly in the trumpet, the necessary variations in length of the air column are secured by means of a slide. As the shape of the tube has no effect on the tone, the very considerable length of tubing required in horns, trumpets, and trombones is brought within convenient and practical limits by bending it into the curved patterns familiar to all.

The **general arrangement of wind-instruments** in an orchestral score is as follows, beginning at the top: piccolo, flutes, (bass flute), oboe, cor anglais, clarinets, (bass clarinet), bassoons, double bassoon, horns, trumpets, trombones, tuba.

WINDLASS. A form of the wheel and axle (q.v.) mechanism used for raising comparatively small loads. The simple hand-turned drum for lifting a bucket of water from a well is an example. It is commonly provided with a pawl to prevent it from turning backwards if the effort is removed. *See* WINCH.

WINDSOR, or NEW WINDSOR. A municipal borough and market town of Berkshire, England, on the Thames, 22 miles west from London, and connected by a bridge with Eton. There are several churches and chapels, barracks, an infirmary, etc. The only manufacture of importance is that of tapestry. Windsor is a popular boating centre, and has associations with Shakespeare. Pop. (1931), 20,284.

WINDSOR CASTLE. Windsor owes its chief importance to its castle, which stands east of the town on a height overlooking the River Thames, and is the principal royal residence in the kingdom. It was begun or at least enlarged by Henry I., and has been altered and added to by almost every sovereign since. The chief features of interest in the castle are the old State apartments; St. George's Chapel, where the Knights of the Garter are installed, and the vaults of which contain the remains of several kings; the Round Tower; and the present State apartments.

Windsor Castle

WINDSOR. A port of Ontario, Canada, on Detroit River, opposite Detroit. The two towns are connected by a suspension bridge, and a vehicular tunnel nearly a mile long. Windsor is an important centre both for the manufacture of motor vehicles, and for railways connecting with American systems by means of car ferries. Pop. (1930), 63,108.

WINDWARD ISLANDS. The administrative title of those British West Indian islands lying north of Trinidad and south of Martinique. They are: Grenada, the Grenadines, St. Lucia, and St. Vincent. Geographically Barbados forms part of the group. At Bridgetown (Barbados; 56 feet altitude) the mean monthly temperature is 79·3° F., and the rainfall about 56 inches. St. George's (Grenada) has a mean annual temperature of 79° F., and a rainfall of 76·6 inches. In St. Vincent the mean monthly temperature is 79° F., and the rainfall 79 inches. *See* ST. LUCIA.

WINES AND SPIRITS. Wines may be either red or white. The colouring-matter of red wine is contained in the skins of black grapes. By itself the wine is blue, but the acids present turn it red. In young wines, where other constituents modify the acids, the colour is almost purple, whereas in older wines it becomes a deep ruby shade. The term *white* applied to wines is hardly correct if milk be taken as an example of a white fluid. They are really yellow, and range from the palest straw to deep golden. White wine can be made from black grapes by withholding the skins, but red wine cannot be made from white grapes.

The more important wines used in this country may be divided into the three main classes of *natural, fortified,* and *sparkling* wines.

Natural wines are those resulting from the natural and complete fermentation of grape-juice without the addition of any other substance, and

form the great bulk of wine produced in the world. They are mostly consumed in the countries of production; of those imported into the United Kingdom the following are the chief.

Claret. A red wine produced in the south-west of France, in the department of Gironde, in the neighbourhood of Bordeaux. The name claret is only applied to this wine in English-speaking countries, and has no justification except centuries of use. In France it is known as Bordeaux red wine. The region of production is divided into three large districts, Médoc, Graves, and St. Émilion, and these are subdivided into numerous communes or parishes, of which the best known are St. Julien, St. Estèphe, Margaux, and Pauillac.

French claret shares with burgundy the distinction of being the finest wine of its kind in the world. Claret is light, containing only about 10 per cent of alcohol. It has a delicate and attractive flavour, being neither too sweet nor too dry; its "bouquet" or aroma is pleasing, it possesses tonic and digestive properties, and it keeps and improves in bottle.

Like all crops depending on natural conditions, the quality of vintages varies from year to year, so that, while a first growth of a successful vintage will be a magnificent wine, the same château of an inferior year may be very poor in quality. The most famous claret vintages are 1864, 1874, 1875, 1893 (when the vintage was the largest for many years), 1899 and 1900. There have been no outstanding vintages since, although 1906, 1911, and 1914 are considered good.

Good claret will keep many years in bottle (1874's are to this day magnificent wines), but when a bottle is opened it should be used quickly, as a couple of days' exposure to the air will turn it flat. It should be kept in cellar at a minimum temperature of 50° F., and used at about 60°. This applies to all *red* wines.

A large quantity of *white wine* is made in the neighbourhood of Bordeaux, mostly to the south-east in the districts of Graves, Sauternes, Barsac, and Preignac. Those wines are very popular in Britain. The Graves are mostly dry, some of the better qualities possessing a most attractive flavour, while the cheaper kinds make very agreeable table wines. In the other districts the wines are sweeter, the fine kinds being distinctly so.

While they show extraordinary bouquet and flavour, their richness is somewhat cloying to the palate, and they are less in demand in this country than the drier kinds. In Sauternes is situated the famous vineyard of Château Yquem. In a fine year this wine is so rich and luscious as to be almost a syrup, while the bouquet and flavour are unique. The duty payable is, in 1933, 4*s*. per gallon.

Burgundy is also the produce of France, the vineyards being situated in the east, in the departments of Yonne, Saône and Loire, and Côte d'Or. The principal districts are Mâcon, Beaujolais, and Côte d'Or, this latter producing the finest and most renowned red wines. The principal towns of the region are Dijon and Beaune, the latter being the centre of the wine trade.

The ordinary wines of Burgundy are stouter, rougher, and sweeter than claret. The finest kinds are more delicate, and have a velvety softness on the palate, combined with very pleasing aroma and delicious flavour. The alcoholic strength runs about 12 per cent.

The vineyards in Burgundy are, as a rule, smaller than in the Bordeaux region, and are usually divided among several owners. On this account Burgundies are generally sold in this country under the names of districts, such as Beaune, Pommard, Nuits, and Volnay. The finest wines are, however sold under the names of their, respective vineyards, viz. Romanée-Conti, Chambertin, Clos de Vougeot, Richebourg, La Tache, etc.

White wines, known in this country as Chablis, are made in the commune of that name, and are very good; but the finest white wine is considered to be Montrachet, from the commune of Puligny, next to it coming Meursault. The finest vintages of Burgundy are 1874, 1885, 1893, 1904, 1911, 1915, and 1919.

Hock is the name applied in this country to German white wines grown on the banks of the Rhine and its tributaries. They are full-bodied, soft, and fruity, and have an attractive aroma. The alcoholic strength is about 12 per cent. The finest kinds are made in the district named Rheingau, extending on the right bank from Biebrich to Rüdesheim. There we find the famous vineyards of Steinberg, Schloss Johannisberg, Marcobrunn, Rüdesheim, etc.

In the neighbourhood of Bingen are situated Nierstein and Oppenheim, which produce lighter and cheaper wines. Close to the town of Worms is the well-known vineyard of Liebfraumilch. Farther south, the Palatinate district produces softer and riper wines, but not so highly flavoured, such as Forst and Deidesheim. Red wines are made, the best being Assmannshausen, but they are little known here. The best vintages are 1884, 1893, 1904, 1911, 1915, and 1917.

Moselle wines are produced on the

anks of the river of that name. They re much lighter and thinner than ock, and generally have a slightly cid taste, but the bouquet is highly eveloped, and in the finer qualities ery attractive. Among the best nown are Berncastler Doctor, Brauneberg, Zeltingen, and Piesport.

A considerable quantity of wine imilar to hock and Moselle is produced in the province of Alsace.

Italian Wines. In this warm southern climate the vine flourishes vigorously, and the quantity of grapes produced is enormous. Unfortunately the quality does not improve in like manner, the wines having a strong, slightly rank flavour, while the dry varieties are inclined to be astringent, and the sweet very rich. Of late years considerable attention has been paid to cultivation, and quality shows improvement. They are useful where a stout beverage wine is wanted.

The best known of the red wines are Chianti, grown in Tuscany; Barolo, in Piedmont; and Lachrymæ Christi, from the slopes of Mount Vesuvius, near Naples, a wine of great reputation, rich and fine flavoured. Near Naples we also get Capri red and white, of which the latter is the more esteemed. The duty on these wines is (1933) 4*s.* per gallon.

Spain produces an enormous quantity of wine, both red and white. The greater part of our import comes under the heading of fortified wine, but we may notice Rioja, grown in the north near Bilbao, and Val de Peñas, both beverage wines similar to claret, but harsher and more astringent in taste.

Austro-Hungary also grows a large quantity of wine, mostly common in quality, which is consumed in the country. A red variety, Carlowitz, of the claret type, was formerly imported in small quantities. In the east of Hungary is made the famous Tokay, a rich golden wine of the liqueur type, which in a good year brings a high price.

In the north of Africa, **Algeria** provides an important quantity of ordinary wine. The bulk of the product goes to France.

In the south, in **Cape Colony**, the soil and climate are very suitable for viticulture, and in the seventeenth century this industry was started by Huguenots expelled from France. For a long period wine of common quality was produced and consumed locally. In the early part of the nineteenth century the British Government took the matter in hand and spent considerable sums in fostering the trade, besides granting a low import duty into Britain. This led to consumption here on a fairly large scale, but later in the century this preferential duty was discontinued, and exports fell off.

The preferential duty in 1933 is 2*s.* per gallon.

In **America** the wines of California were of most interest to our market, but during the period of prohibition the manufacture ceased. In **South America,** Chile and the Argentine produce large quantities of wine, which are entirely consumed on that continent and rarely exported to Europe.

Australia. The cultivation of the vine in Australia is of comparatively recent date, having commenced about the year 1830. In many parts of that continent soil and climate are favourable, the principal drawback being drought and heat, which make great care in cultivation and manufacture necessary. Australian wines are thick, soft, and heavier than European wines, but suitable for beverage purposes.

Port. Among *fortified wines* the most important is *port.* This is a red wine grown on the hilly banks of the upper part of the River Douro, in Portugal, and shipped from Oporto, whence its name. In its manufacture fermentation of the must is arrested by the addition of brandy made from commoner wines of the country. If a sweet wine be desired, the addition is made before fermentation has proceeded far, and sugar is thereby retained; if, on the contrary, a dry wine be wanted, fermentation is allowed to continue longer.

Port as shipped to Britain generally contains a high percentage of alcohol. and duty is 8*s.* per gallon (1933). This high proportion of alcohol, along with the stout, rich nature of the wine, renders it very suitable for the comparatively cold, damp climate of this country, where it has for centuries enjoyed great popularity.

The wine trade in Oporto is largely in the hands of English firms, descendants of merchants who settled there about the seventeenth century. In contrast to the custom of selling claret and burgundy under the names of the different château or districts, ports are blended by the shippers and sold under their names, with marks attached denoting quality. Very few wines of particular vineyards, or *quintas,* as they are called, are sold individually.

The finest vintages are 1847, 1863, 1870, 1878, 1887, 1890, 1896, 1900, 1904, 1908, 1912, 1917; and of these 1896 and 1908 are outstanding.

In ordinary years, when quality is not so exceptional, the wines are stored in casks by the shippers in their cellars or "lodges," and allowed to mature there. During this process the wine, while improving in quality,

loses colour and body, and when very old becomes reddish-brown in colour, or what is known as "tawny." These wines are lighter, and to some palates more suitable and agreeable, than the very robust and heavy vintage wines.

White port is also made, and a considerable quantity imported, but the wines are wanting in the characteristics of the red varieties, and are not so attractive.

Outside the Douro district, a large quantity of wine is made in Portugal, and a considerable quantity is exported to Britain. It is known as Lisbon Red, and is commoner and wanting in the fine flavour of genuine port. By a treaty between Britain and Portugal only wine from the Upper Douro can be sold as port in this country.

Sherry is a white wine made in the south-west corner of Spain, in Western Andalusia, the centre of which is Jerez, whence the wine takes its name. In its manufacture the must is allowed to ferment naturally, but the peculiarity of sherry is that a second slow fermentation takes place in the cellars (or *bodegas* as they are called), lasting for eighteen to twenty-four months.

This second fermentation is very uncertain in its action. The pale, delicate, dry wines are called "fino" (or "palma"), the fuller-bodied dry wines "cortado," and the darker-coloured and richer wines "raya."

These different varieties are all blended, and fortified by the addition of brandy before shipment, and are generally sold in Britain under names such as Vino de Pasto (light colour, delicate dry flavour), Amontillado (very dry, with more body), Oloroso (full golden colour and soft rich flavour), East India (dark colour, sweet full body), Manzanilla (very dry, with flavour of camomile flowers), etc.

The alcoholic strength is fairly high, and duty 8*s*. per gallon. One feature which may be noticed is that sherry keeps better after being opened and exposed to the air than any other wine.

Malaga, shipped from the port of that name, is a white wine grown in Eastern Andalusia. It is different in style from sherry, being generally sweeter. It is not much used in Britain.

Tarragona is a red wine grown in Catalonia, and largely exported to this country. It somewhat resembles port in character, but is much inferior in quality and cheaper in price.

Marsala is a white wine produced in the island of Sicily, resembling sherry, but softer and more fruity. It was largely used in the British navy for many years. One of the leading houses in Palermo has in its possession an order for this wine signed by Lor Nelson. The quantity imported not large; duty, 8*s*. per gallon.

Madeira is produced in the islan of that name, the soil of which consist of disintegrated lava, and is peculiarl suitable for the vine. Madeira has very pronounced and distinctiv flavour, besides being full and soft. I varies in colour from pale golden t dark brown, and will keep for man years in bottle; duty, 8*s*. per gallon

Vermouth, a white wine flavoure with aromatic herbs, is now largely used in this country. There are two kinds—French (dry), made in the neighbourhood of Marseilles, and Italian (sweet), made in Turin.

Sparkling Wines. Of these the best know is champagne, made in the north of France, in the department of Marne, with the towns of Rheims and Épernay as centres of manufacture and distribution. This district formed part of the old province of Champagne. It is about as far north as the vine can be cultivated; hence we have a small yield of grapes producing a wine of exceptional flavour and delicacy.

The art of retaining natural effervescence in champagne is attributed to Dom Pérignon, of the monastery of Haut Villers, who died in 1715. Great care is necessary in the manufacture; the grapes are examined, and any doubtful or unripe rejected. They are then pressed and the must allowed to ferment. Vintage generally takes place in September, and in spring following the different wines intended to form a blend are mixed together in a large vat. This is called a "cuvée," and the wine is immediately bottled and corks fastened down.

For the British market, where dry wines are required, $\frac{1}{2}$ per cent of liqueur may be added, while for France or other countries, where a sweeter wine is in demand, as much as 5 per cent may be necessary. Only the finest wines are usually sent to this country, and the best vintages are 1900, 1904, 1906, 1911, and 1914.

The alcoholic strength of champagne is about 11 per cent, and duty (1933) is 32*s*. per dozen bottles (2 gallons).

In the west of France, in the valley of the Loire, which flows through Touraine and Anjou, a considerable quantity of *white sparkling wine* is made. This is light and pleasant, but wanting in flavour and delicacy as compared with champagne, nor has it the same keeping properties. It is known as Saumur.

Sparkling Burgundy. In the Burgundy district a red sparkling wine is made for which there is some demand.

ed wines do not adapt themselves the sparkling state so well as white, ie most noticeable difference being the eye. The clear amber liquid ith tiny globules streaming to the rface is much more attractive than n opaque red wine with froth on the rface.

Sparkling hock and **Moselle** are hite wines made in Germany by the ame method as champagne. They re coarser and more fruity than the tter, and generally sweeter. In Italy nany sparkling wines are made, the est known here being Asti, but im- orts are small.

Spirits. All fermented liquors con- ain a certain amount of alcohol, and hen this is separated from the other onstituents by distillation the pro- luct is called *spirits*. The art of dis- illation is not of such great antiquity s the manufacture of wine. The first ecord extant of its use in the pre- aration of a beverage is in the leventh century, and it does not ppear to have been introduced into ngland until the sixteenth century. he product of the early efforts was o doubt crude, nevertheless it was nuch prized as a medicine, and as nethods were gradually perfected the lemand increased. The first spirit vas made from wine and called *brant ein* (burnt wine) or brandy.

Brandy is the product of the dis- illation of wine made from grapes. t is produced in almost every country here wine is made, but the finest uality, and what is generally known n this country as brandy, without eing distinguished by the country f origin, is made in the west of rance, round the town of Cognac, n the River Charente, in the depart- nent of that name. This region pro- uces a thin, highly flavoured white ine, which on being distilled yields eau de vie de Cognac," a brandy hich in point of quality takes pre- edence over all others.

Distillation is effected in pot stills, nd when newly made the spirit is olourless. It is stored in oak casks nd allowed to mature for many years, uring which time the colour becomes eep yellow, and flavour and bouquet, ue to essential oils in the spirit, de- elop in all their perfection.

The production in an average year s in round figures 3 million gallons. Brandy is usually sold in Britain at strength of 30 under proof (Sykes), n which duty in 1933 is 75*s.* 6*d.* per roof gallon.

Whisky (from Gael. *uisge*, water). he manufacture of whisky seems to ave commenced in the eleventh cen- ury in the Highlands of Scotland, nd probably soon after in Ireland. ethods were then very primitive, re- sulting in a coarse and acrid spirit which does not seem to have spread far until the seventeenth century, when it came into use in the Low- lands of Scotland.

Scotch whisky is of two main kinds, *malt* and *grain*. The former is made from malted barley in pot stills, and the latter from unmalted grain, gener- ally maize, with a small proportion of malt added, in patent stills (*see* STILL). Owing to materials used and method of manufacture, malt whisky is much richer in ethers and essential oils, and is more pronounced in taste and smell than grain whisky, this latter being more neutral.

Scotch malt whiskies may be classed in four categories, viz. Highland, Low- land, Islay, and Campbeltown. The difference in each class is very marked, owing to natural causes, such as the quality of the water, and the flavour imparted to the malt by peat used in drying.

Whisky is, like all spirit, colourless when newly distilled, but during the process of maturing in casks it ac- quires a yellowish colour. By law, whisky must be three years old before it can be sold for consumption. Fifty years ago Scotch whisky was little known outside Scotland, but it is now known and largely consumed all over the world.

Irish whisky is likewise made both in pot and patent stills, the produce of the latter resembling Scotch grain. Owing to the use of a mixture of malt, unmalted grain, and oats, Irish pot-still whisky differs considerably from Scotch, being heavier and sweeter, and having an oily taste as against the clean, crisp, dry flavour of the latter; and outside Ireland is not so much in demand.

The excise duty on whisky in 1933 is 72*s.* 6*d.* per proof gallon (Sykes). It is generally sold at a strength of 30 under proof (about 40 per cent alcohol), so that duty on a bottle of whisky containing one-sixth of a gallon amounted to 8*s.* 5½*d.*

Gin is a spirit made from grain flavoured with juniper berries and other aromatic substances. Holland is the largest gin-producing country, and Britain comes next, London and Plymouth being the principal places of manufacture. There is a consider- able difference in taste between Dutch and English gin, the former having what may be described as a yeasty flavour, while the latter is much cleaner and to most people more attractive. " Old Tom " is the name given to English gin which has been slightly sweetened. Gin, being a highly rectified and pure spirit, does not require to be kept like whisky, and is generally used soon after manu-

facture. The duty in 1933 is 72*s.* 6*d.* per proof gallon.

Rum is a spirit made from molasses, a substance produced in the manufacture of cane-sugar, and is made in all countries where this industry is carried on, but Jamaica and Demerara are the principal sources of supply for Britain. From the rich nature of its source, rum has perhaps the greatest food value of any spirit, and it certainly has the property of imparting a feeling of warmth to the human system; hence its selection for the use of our troops during the European War. It has long been used in the navy.

In 1933 duty on rum is 72*s.* 6*d.* per proof gallon.

Liqueurs are beverages artificially prepared from alcohol, sugar, and an endless variety of flavouring substances. They are very numerous, and we can only notice a few. *Benedictine* is made at Fécamp, in France. *Chartreuse* was formerly made at the monastery of that name near Grenoble, but the monks on removing to Spain carried the manufacture with them. *Curaçao* derives its flavour from oranges, *crême de menthe* from peppermint, *kirsch* from cherries, *absinthe* from wormwood, *kummel* from cumin or caraway seed, and *Maraschino* from marasca cherries.

BIBLIOGRAPHY: Thudichum and Dupré, *Treatise on Origin, Nature, and Varieties of Wine*; J. C. W. Thudichum, *Treatise on Wine*; A. L. Simon, *History of the Wine Trade in England*; *Wines and Spirits*; Nettlefield, *Distilleries of the United Kingdom*; G. E. B. Saintsbury, *Notes on a Cellar Book*.

WINGATE, Sir Reginald. British soldier; born in Renfrewshire, 1861. He joined the Royal Artillery in 1880, and in 1883 was posted to the Egyptian army, beginning a long connection with Egyptian affairs, during which he became Sirdar and Governor-General of the Sudan (1899-1916), and High Commissioner in Egypt (1917-9). He conquered Darfur (1916), and was General Officer Commanding in the Hedjaz from 1916 until 1919. He retired in 1922, and became Chairman of Tanganyika Concession, Ltd., and Associated Companies. In 1926 he received the Gold Medal of the African Society. Among his publications the chief one is the English edition of Slatin Pasha's *Fire and Sword in the Sudan* (1895).

WINNIPEG. A lake of Canada, mainly in Manitoba; length, about 260 miles; greatest breadth, 70 miles. The Winnipeg, Red River and Saskatchewan are its tributaries, and it receives the surplus waters of Lakes Winnipegosis and Manitoba, while its own surplus waters ar Nelson into Hudson B Winnipeg rises in th Woods; length, 250 mi by falls.

WINNIPEG. The Canada, capital of t Manitoba, at the co Red River and Assini south by west of Lak 1870 it was only a vill has been due in great central position on forming a gateway t north-west, and in a agricultural and other been rapidly develop help of railways and i come a great commerc centre, with fourteen railway lines radiating great grain market, a trade in cattle, flour, c while manufacturing progressive. The pr sity, founded in 1877, There are two broad (48·8 m., 3·5 kw., 2 kw.). Pop. (1 Greater Winnipeg, 30

WINNIPEGOSIS. toba, Canada, drained Lake Manitoba, thr Lake and Waterhen I feet altitude, from 1 long, and has an ar miles. The coast approximately 600 mi

WINONA. A city United States, the Winona county, a ri Mississippi; served Great Western and It is an educational extensive manufactur 1853, it became a cit (1930), 20,850.

WINTER ACONITE *Cammarum* (*Eranthis* ord. Ranunculaceæ, p yellow flowers very e

WINTER-CRESS. name of two British cr of the genus Barbare called also *yellow rock* banks of ditches and r hedges and walls. I sharp to the taste, a used as a salad.

WINTER-GREEN. several plants, one of partridge-berry (q.v.) *oil of winter-green*, *oil of gaultheria*. T almost entirely of m and is valuable as a rheumatics. The nam a genus of perennial order Pyrolaceæ, havi

road evergreen leaves, and usually racemose white or pink flowers. *P. rotundifolia* possesses astringent properties, and was formerly used in medicine.

WINTER-MOTH. A moth (*Cheimatobia brumāta*), the larvæ of which are exceedingly injurious to apple, pear, cherry, and plum trees. The moths appear in their perfect state in the beginning of winter. Pupation takes place in the ground, and the wingless females can be prevented from climbing fruit-trees by tarring or grease-banding their trunks.

WINTER'S-BARK (*Drimys Winteri*). A plant of the nat. ord. Magnoliaceæ, a native of South America. It is an evergreen shrub, the bark of which has an agreeable pungent aromatic taste, and tonic properties.

WINTERTHUR. A town of Switzerland, canton of Zürich, on the Eulach; an important railway junction. It carries on cotton-spinning, silk-weaving, iron-foundries, machine-making, etc. Pop. (1930), 53,925.

WIRE, BOWDEN. The Bowden system of transmission of force consists of a practically inextensible wire cable threaded through a practically incompressible flexible tube, the tube being formed by a closely coiled spiral steel wire. The mechanism is complete in itself, and only requires to have one member fixed at both ends, and the other member attached to the operating lever at one end and the object to be moved at the other end. The steel cable may be anchored, and the flexible tube then used as a medium for pushing.

WIRELESS TELEGRAPHY AND TELEPHONY. Wireless telegraphy is the art of signalling through space by means of *electro-magnetic waves* or *displacement currents* in the ether, the to-and-fro alternations of which, or the *frequency*, for commercial purposes being comprised within the present practical limits of 3×10^{10} per second and 10^4 per second, corresponding to wave-lengths in free space of 10 centimetres and 30,000 metres. The important part played by the non-conducting medium in electrical actions was demonstrated by Faraday in 1837, when he showed that the charge given to an electric condenser does not reside in the conductors, the metal plates, but in the so-called insulator, the air or glass between the plates.

He represented the charge by "lines of force" stretched through the non-conductor with their ends fixed to the conductors; and when the insulating medium is considered in its relation to the forces acting in this way through it, he proposed "to use the word *dielectric* to express that substance."

The fact that a steel needle was sometimes magnetised in one direction and sometimes in the opposite direction by the discharge current of a condenser, led Joseph Henry, in 1842, to the conclusion that under certain conditions the condenser discharge is oscillatory; and in 1853 William Thomson (Lord Kelvin) worked out the mathematical theory, and showed that if the discharge takes place through a circuit of low electrical resistance, the current does not die out at once but first charges the condenser in the opposite sense, then again in the same sense, the storage of energy being transferred from the condenser to the magnetic field, then back again to the condenser, and so on, the amplitude of the current gradually growing less, and the oscillation finally dying out when all the energy in the circuit has been transformed into heat.

If E is the total energy in the circuit—the dissipation of energy being neglected—C the capacity, L the inductance, Q and i the charge and current respectively at any instant, then $E = \frac{1}{2}Q^2/C + \frac{1}{2}Li^2$. If n is the frequency of the oscillations per second, T the periodic time of the oscillations in seconds, L the inductance of the circuit in henrys, C the capacity in farads, then if the resistance of the circuit can be neglected, $T = 2\pi\sqrt{LC}$ and $n = 1/(2\pi\sqrt{LC})$.

Feddersen, in 1857, was the first to obtain experimental confirmation of the oscillatory nature of the condenser discharge. When the image of the spark was spread out by means of a rotating mirror, it was seen to consist of a number of sparks following each other at regular intervals.

Clerk Maxwell's epoch-making paper, *A Dynamical Theory of the Electro-magnetic Field*, was read in 1864. Maxwell's views (*see* ETHER; WAVE THEORY OF LIGHT) partook of the nature of highly interesting speculations until 1888, when convincing evidence of their truth was provided by the brilliant research work of Heinrich Hertz. Hertz endeavoured to produce in a condenser circuit electric oscillations of extremely high frequency, and he therefore used a condenser of very small capacity and connections of very small inductance. Employing an air dielectric, he separated the two conductors as far apart as their connections would allow.

The arrangement he called his large oscillator consisted of two spheres of zinc 30 cm. in diameter at the extremities of two metal rods placed in line, with their inside ends terminating in brass knobs of 3 cm. diameter,

between which a spark discharge was made to take place. The two rods and spark gap measured 150 cm. over all, and the calculated oscillation frequency of the spark was 5×10^7 per second.

The electrostatic field of this *dumb-bell* oscillator bulged well into the surrounding space, and Hertz had thus discovered the best form of condenser for producing electro-magnetic waves, because during the periodic oscillations of the charge a maximum proportion of energy permanently leaves such a condenser circuit as waves of displacement current in the surrounding dielectric.

For detecting these waves Hertz employed a *resonator*, a loop of wire broken by a small adjustable air gap.

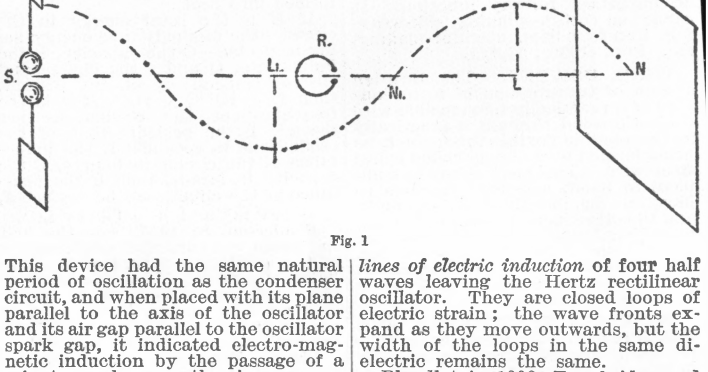


Fig. 1

This device had the same natural period of oscillation as the condenser circuit, and when placed with its plane parallel to the axis of the oscillator and its air gap parallel to the oscillator spark gap, it indicated electro-magnetic induction by the passage of a minute spark across the air gap.

Oliver Lodge had already produced stationary waves on wires by reflection and interference, and Hertz adopted the same principle to produce in the air dielectric electro-magnetic waves which were stationary and could therefore be examined.

In fig. 1 the spark of the oscillator O is indicated at S, a sheet of zinc 2 metres × 4 metres at M was used as a reflector, and the resonator R was moved along the axis SN to determine the character of the radiation sent off from O. When the distance SN is suitable, the resonator will show no spark at N, a maximum spark at L, no spark again at N_1, and a second maximum at L_1, as indicated by the dotted curve.

The two points N and N_1, being positions where there is no electric force, must be nodal positions of the stationary electro-magnetic wave and the distance between them must be half a wave-length. The points L and L_1 are called *loops of electric force* and the distance between them also half a wave-length.

For the oscillator in question the radiated waves had a length of metres. In other experiments employing his small or rectilinear oscillator—two short rods fitted with spark balls each rod and ball being 13 cm. over all—he used a frequency of 5×10^8 and a wave-length of 60 cm. Hertz showed by experiment that electro-magnetic waves as thus produced could be reflected, refracted, and polarised, being having in these and other ways very much like waves of light (*see* HERTZ HERTZIAN WAVES). Fig. 2 shows the

lines of electric induction of four half waves leaving the Hertz rectilinear oscillator. They are closed loops of electric strain; the wave fronts expand as they move outwards, but the width of the loops in the same dielectric remains the same.

Blondlot in 1893, Trowbridge and Duane in 1895, and Saunders in 1896, by various experiments, particularly by photographing the spark images of a train of oscillations obtained in a revolving mirror and measuring the interval between them, finally removed all doubt that electro-magnetic waves have the same velocity as light waves, namely 3×10^{10} cm. per second. If the capacity C of the transmitter circuit is measured in *microfarads*, and the inductance L in *microhenrys*, then the wave-length of the radiation in air or free space, measured in *metres*, will be given by the formula $\lambda = 1885\sqrt{LC}$.

The spark indicator of the Hertz resonator required an induced E.M.F. of several volts, and was therefore a very insensitive form of detector. Branly, in 1892, employed a "coherer" for this purpose, a glass tube

ontaining loosely-packed, finely-di-ided metal filings, which by its large hange of conductivity on the appli-ation of a small E.M.F. made it ossible to detect the presence of eeble electro-magnetic waves or aves which had become feeble by xpansion in travelling to a distance.

Wireless telegraphy as an art prac-ically dates from the employment of his instrument. The first practical vorking circuit was demonstrated by Guglielmo Marconi in 1895, and in 1896 he improved the transmitter by elevating the conductor, a sheet of zinc connected to one side of a spark ball oscillator, and connecting the other side to ground, a similar arrange-ment of elevated plate and ground wire being connected to a coherer of special design at the receiving end.

But the great advantage of height was demonstrated in the following year when, discarding the capacity area, a single wire, supported some-times by balloon, sometimes by kite, was used by Marconi for signalling up to a distance of 34 miles, a ground connection to the oscillator also being employed. The vertical wire has been given the name *aerial* or *antenna*.

The very important principles of the reservoir circuit and *tuning* were introduced by Marconi in 1900. In-stead of the generator feeding energy direct into the aerial, it was made to excite a closed oscillating circuit of low resistance, which lost very little of its energy by radiation; and this circuit was inductively coupled to the aerial system which, being of the open type, was a good radiator.

The energy lost by the aerial is replaced by energy taken up in-ductively from the closed circuit, and so more energy can be radiated. The closed and the open circuit were ad-justed to be in resonance. Similar coupled circuits in resonance were also introduced in the receiver, and the receiver was adjusted to be in resonance or *in tune* with the trans-mitter.

The term *coupling* designates the degree to which one circuit is electro-magnetically linked with another cir-cuit.

The effect of coupling k on two cir-cuits having the same natural wave-length λ_0 is to produce in both of them two new wave-lengths λ_1 and λ_2, such that $\lambda_1^2 = \lambda_0^2(1 + k)$, and $\lambda_2^2 = \lambda_0^2(1 - k)$, so that $k = (\lambda_1^2 - \lambda_2^2)/(\lambda_1^2 + \lambda_2^2)$; and $100k$ is called the percentage coupling.

In Dec., 1901, Marconi received the first signals across the Atlantic at St. John's, Newfoundland, from Poldhu, Cornwall, a distance of 1800 miles, and thus proved that electro-magnetic waves are able to bend round the curvature of the earth. The trans-mitting power was 12 kilowatts; wave length, 400 metres; height of aerial, 200 feet. At St. John's he employed a kite-flown aerial, a tuned receiver circuit, and a coherer developed by the Italian navy, consisting of a blob of mercury between plugs of carbon and iron mounted in a glass tube.

The magnetic detector of Marconi, which depends on the effect of high-frequency currents on the magnetic state of a moving band of iron wire, displaced the coherer in 1902. In this instrument the signals are re-ceived on a telephone. The telephone itself cannot respond to changes as rapid as those produced by high-

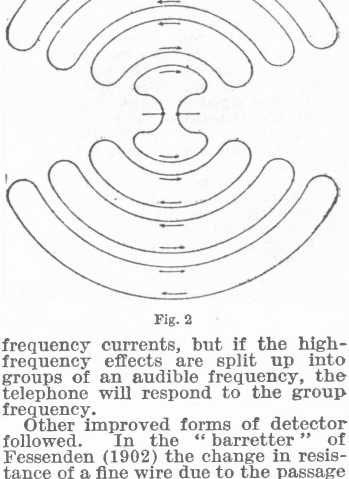


Fig. 2

frequency currents, but if the high-frequency effects are split up into groups of an audible frequency, the telephone will respond to the group frequency.

Other improved forms of detector followed. In the "barretter" of Fessenden (1902) the change in resis-tance of a fine wire due to the passage of the high-frequency current is made to alter the current in a telephone circuit so that the telephone responds. In 1906 H. C. Dunwoody discovered the carborundum-steel combination, the first and unquestionably the most reliable although not the most sensi-tive of the numerous *crystal detector* class, which includes tellurium-alu-minium and tellurium-silicon, used by L. W. Austin in 1906, and silicon, zincite, chalco-pyrites, bornite, and molybdenite, patented by G. W. Pickard at various dates from 1906.

If an alternating E.M.F. is applied to a crystal detector, the positive half will produce a much larger current than the negative half, or vice versa,

and the integration of the effect will have the effect of *an interrupted direct current*. The crystal therefore acts as a *rectifier*. The telephone cannot respond to high-frequency impulses, but it can respond to groups of such impulses rectified in this manner if the group frequency is within the audible limits.

The transmission of signals is therefore arranged accordingly. In practice the signal E.M.F. is extremely small, and better results are therefore obtained by applying a constant E.M.F. to the crystal to cause it to work at that position on the characteristic at which the greatest *rate-of-change* of current with applied E.M.F. takes place, the actual position always being found by trial. See also section under *Thermionic Valve*.

Direction Finding : Range. In the "frame aerial" method of direction finding the receiving aerial consists of two vertical parts which can be rotated. The current in the receiver is a maximum when the direction of the incoming wave lies in the plane of the frame. In a modified system two aerials are fixed at right angles, and a search coil rotates. For the benefit of shipping, short-wave directional beam stations have been set up at Inchkeith and South Foreland. The directive element is got by means of a rotating aerial, the signal from which varies with the position of the aerial. The signal which a ship picks up most strongly indicates the bearing of the sending station.

Problems relating to the range of signals have been much studied. Some of the facts are very curious. The wave-length, the power used, and the time of day are the important factors. Waves of about 1000 metres long travel much better by night than by day. Waves of 30 metres can be detected up to 50 miles, disappear from 50 to 500 miles, and reappear from 500 up to 1500 miles. Extreme ranges are at times attained with very elementary apparatus.

Wave-length : Beam Wireless. For many years short waves (say 5 to 100 metres) were regarded as impracticable for long-distance work on account of their rapid absorption. The wave-lengths used in commercial stations designed before 1926 vary from 8000 to 30,000 metres. The great Post Office station at Rugby, for example, is capable of dealing with a continuous output to the aerial of 500 kilowatts at a wave-length of 18,000 metres, and has a world-wide range over the twenty-four hours of the day. The aerial is supported by eight towers, each 820 feet high. Many similar stations are in operation on the Continent and in America.

The cost of these large static about £500,000. With a vie evolving a cheaper system, Ma and C. S. Franklin began about to experiment with short waves, ultimately demonstrated their plete practicability. A row of ac backed by a series of reflectors, essential feature of the system eventually devised. In 1924 the coni Company entered into an ag ment with the British Post Offic the supply of stations on this sh wave "beam" system capable communicating to and from Can South Africa, India, and Austral

The stations were to be wor through land lines from the Cen Telegraph Office in London. In O 1926, the station for correspond with Canada was certified by engineer-in-chief of the Post Office have passed all the stipulated tes

The Heaviside Layer. Wireless wa do not spread out in straight lines i space, but travel round the eart surface. Mathematical theories ha been given, but the signals actua received at great distances are so thousands of times stronger th theory predicts. The generally a cepted explanation is that the effe is due to ionisation (q.v.), as a resu of which the upper atmosphere b comes practically a conducting sh concentric with the earth's surfa and capable of reflecting the wave This shell is usually called the Heav side layer. It is conjectured that th ionisation may be caused by an actu stream of solar electrons, which ma possibly have some relation to sun spots.

The High-frequency Generator. I order to charge his oscillator Hert employed a Ruhmkorff induction coi This machine was used in the firs commercial installation to charge th aerial earth system directly, and thi method of transmission was calle "plain aerial." The demand fo greater range of transmission led t the use of alternators and trans formers, and the fixed electrode dis charger was replaced by the rotary discharger, which, besides increasing the power which could be dealt with, effected an immense improvement in the regularity of the spark, so that the sending station could be recognised by its note.

In the Marconi tuned transmitter circuits the coupling must be weak, and careful tuning is relied on to bring the aerial oscillation up to its maximum by resonance. Max Wien pointed out in 1906 that tight coupling can be employed, and therefore much more energy can be transferred to the aerial without the production of two coupling waves if the

spark in the primary circuit is rapidly quenched.

The Telefunken quenched spark gap, patented in 1908, works very efficiently, and has been used on transmitting plant of considerable power. It consists of a series of copper plates with their central sparking surfaces heavily silvered and separated by mica rings.

The *arc generator* dates from 1900, when W. Duddell showed that if a condenser of suitable capacity and an inductance are connected in series across the terminals of a direct-current arc (the two electrodes being solid carbon rods), then the arc gives out a note the pitch of which corresponds to the frequency of oscillation of the condenser-inductance circuit completed through the arc.

In 1903 V. Poulsen described an arc circuit which allowed oscillatory currents to be generated of a very much higher frequency than was possible with the Duddell arc, and also allowed much more power to be used. His improvements consisted in the use of a hydrogenous atmosphere, a magnetic field transverse to the arc, a water-cooled copper anode, and a rotating carbon cathode. The peak of development of the spark transmitter was reached in 1912 by Marconi in his *timed-spark* method of producing continuous oscillations.

If there are several electrically similar circuits each discharging through its own rotary spark gap and producing at constant intervals trains of decaying oscillations, and if all these circuits induce into a common aerial circuit and the discharges are timed so that the induced oscillations in the aerial both overlap and are in phase, then the equivalent of a current of constant amplitude can be produced, or what is known as *continuous wave* (C.W.). Transmitters of this type of 200-300 kw. have been used, the frequency being 21,400, corresponding to a wave-length of 14,000 metres.

In 1908 R. Goldschmidt patented a high-frequency alternator which depends on the mutual induction effects of the currents in the stator and rotor windings of a machine specially built to encourage them. High-frequency alternators were made a practical success by Alexanderson in 1909. He employed a constant field, and varied the flux through the armature coils by means of an "inductor" rotor which interposes a succession of narrow iron spokes between the poles in the faces of which are inset the armature windings.

Each winding consists of a single zigzag wire, a succession of "coil elements," and the frequency of the induced current is given by the product of the speed of the rotor and the number of inductor spokes, a spoke and slot in the rotor corresponding to a pair of north and south poles in a standard alternator.

The aerial circuit must be in resonance with this alternator in order that it shall give its full output, and special high-frequency control is employed to maintain the constancy of the alternator speed. Alternators on this principle are in use of 200 kw. output at 30,000 cycles, corresponding to 10,000 metres wave-length; there are also others of smaller output and higher frequency.

Thermionic Valve. The experiments of Elster and Geitel (1882-9), Edison (1884), J. A. Fleming (1890), and J. J. Thomson (1899) demonstrated that if a cold metal plate is mounted near an incandescent filament in an exhausted glass bulb, it takes up a charge which it receives from the negative leg of the filament, but it receives no electrification from the positive leg; also that the charge is conveyed by electrons (*see* ELECTRON).

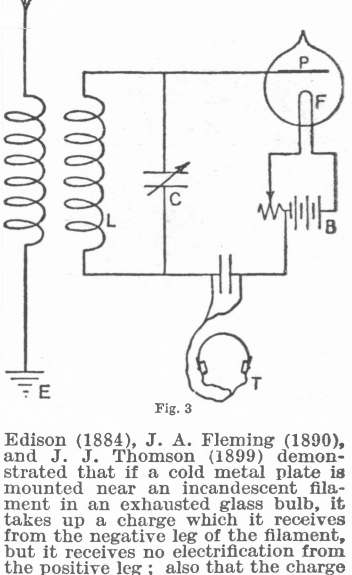


Fig. 3

In 1903 O. W. Richardson showed that the rate of emission of electrons from incandescent bodies could be expressed in the form $N = a\sqrt{T}e^{-b/T}$, where N is the number of electrons emitted per square centimetre of the hot body per second, T is the absolute temperature of the body, and a and b are constants. J. A. Fleming, in

1904, was the first to apply the so-called "Edison effect" mentioned above to the rectification of alternating currents of any frequency, and produced what is now known as the *two-electrode valve*.

The principle on which it works as a detector of high-frequency signal currents is illustrated in fig. 3. F is a carbon or metal filament made incandescent by current from a battery B, and P is a metal plate mounted in the same exhausted bulb as F. The oscillatory circuit LC is coupled to the aerial circuit AE, and is tuned to the same frequency as the signal current by varying the capacity of C. The

If for a given filament current, an therefore a given filament tempera ture, a fixed positive potential applied to the plate—which is als called the *anode*, as only positiv potentials are applied to it—then steady unvarying current will flo through the plate circuit. The thir electrode inserted by Lee de Fores is employed to control this plat current, and as it is usually inserte between the filament and the plate and the plate current has to flow pas it or transversely through it, it i given an open form like a spiral o wire mesh, and is called the *grid*. A negative potential applied to the grid

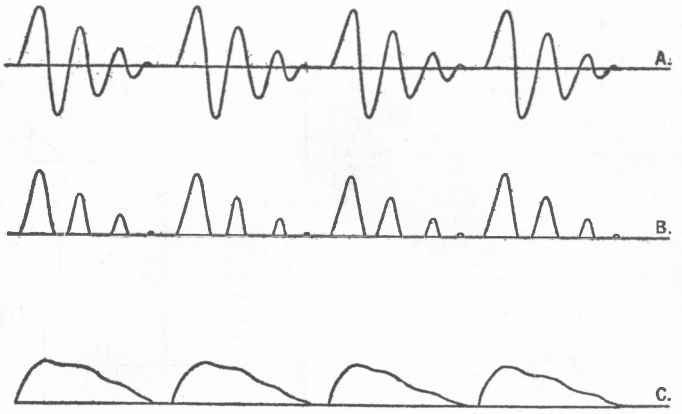


Fig. 4

trains of oscillations induced in LC corresponding to the transmitted spark signals are indicated in fig. 4A. This results in an oscillating potential being applied to P, the positive part only of which produces a current flowing through the valve from F to P, having the rectified form shown in fig. 4B. A condenser is shunted across the telephone T to provide a path of low impedance for these oscillations, and the current through the telephone assumes the form shown in fig. 4C as a result of the mean value of the varying potential difference between its two terminals, so that there are as many impulses applied to the diaphragm as there are trains of oscillations, and the note produced will have a corresponding audible frequency which can be cut up into shorts and longs for the transmission of code messages.

Lee de Forest, in 1907, described the first *three-electrode valve* (fig. 5).

will oppose the flow of the negatively charged electrons to the plate, and so will reduce the plate current; and a positive potential applied to the grid will encourage the flow to the plate.

Thus a change in potential of the grid, which may be brought about by the application of a negligible amount of electrostatic energy, may control the discharge of the energy stored in the comparatively large reservoir provided by the plate battery B_2. If the potential changes caused by a very weak signal are applied to the grid, a very much amplified signal can be obtained in the plate circuit; and further, if the valve circuits are properly adjusted, all the characteristics of the signal are amplified in the same proportion, so that all irregularities of wave-form are reproduced without distortion.

The *grid-plate characteristic* of a three-electrode valve, as obtained with

circuit of fig. 5, showing the change plate current with change of grid ential for fixed values of filament rent and plate voltage, is given in 6. For comparison the *plate racteristic* of the same valve is also en in the figure, as it shows the tion between the plate current and plate voltage when two electrodes y are used, viz. the filament and

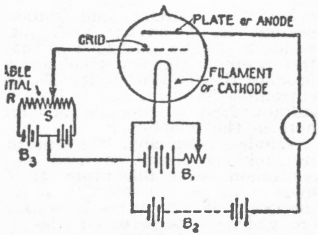


Fig. 5

plate, the grid being joined to the ative leg of the filament.

'or *rectification* there must be an mmetrical change of plate current a symmetrical change of plate tage applied to the two-electrode ve, or of the grid voltage applied the three-electrode valve; and operation takes place, therefore, en the valve is adjusted to work

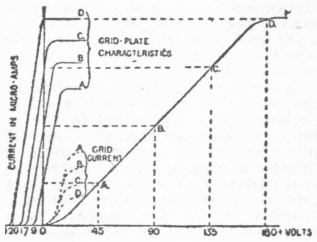


Fig. 6

the top or bottom bend of its racteristic.

n adjustment on the straight in- ed part of the curve is of no ctical value with the two-electrode ve, but the three-electrode valve st be adjusted to work at this ition on the grid-plate charac- stic when it is required to amplify hout distortion, the drop in plate rent due to the application of a ative charge to the grid being then al to the rise in plate current when equal positive charge is applied to grid. *High-frequency amplifica-* takes place when the signal rent is amplified before being recti- fied; *low-frequency amplification* takes place after rectification.

Retroaction, a very important property of a valve circuit, introduced by C. S. Franklin in 1913, takes place when the plate circuit is made to transfer part of its energy to the grid circuit, with the object of increasing the amplifying effect in the plate circuit. In fig. 7 a coupling between the two circuits is shown at L_pL_g. When the plate circuit is closed by the switch K, a current flows from the filament F to the plate P and through the coil L_p. The growth of the magnetic field in L_p cuts L_g and generates in it an opposing E.M.F. which is immediately applied to the

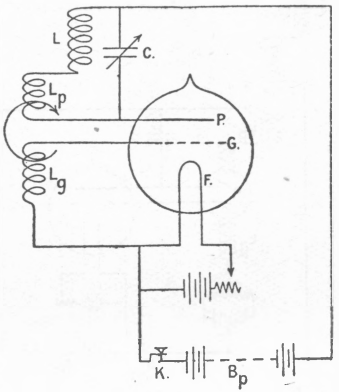


Fig. 7

grid G and checks the flow of current from the filament to the plate.

The fall in the plate current, and in the magnetic field produced by the coil L_p, generates an E.M.F. in L_g which tends to maintain the magnetic field and therefore assists the passage of the current from F to P, and so once more the plate current increases, and the process is repeated, the periodicity being determined in this case by the time constant of the plate circuit as given by the inductances L and L_p and the condenser C.

In the circuit adjustment just mentioned the E.M.F. induced on the grid was in the first instance negative and in the second instance positive. By rotating one of the two coupling coils, or by reversing the connections, it is clear that retroaction can be used to reduce instead of to increase the amplification in the plate circuit; in fact a useful range of amplification adjustment can be obtained with a

reaction coil, which gives an adjustable coupling.

The Valve Oscillator Generator. It is only one step farther to find by trial a reaction adjustment which will keep the high frequency circuit L_pLK in permanent oscillation, the energy fed into it every cycle from the battery B_p being just sufficient to compensate for the energy which leaves the circuit during the same period, the circuit itself arranging the correct timing of the feed from the battery in the manner already described. This development was due

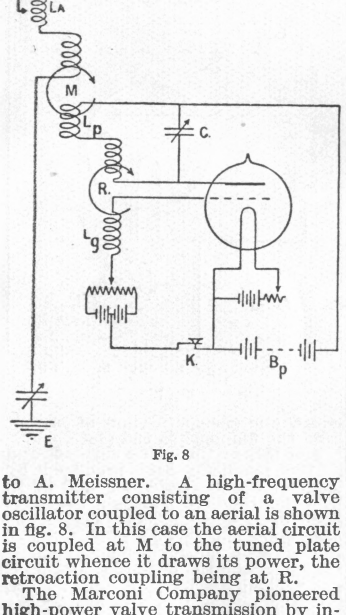


Fig. 8

to A. Meissner. A high-frequency transmitter consisting of a valve oscillator coupled to an aerial is shown in fig. 8. In this case the aerial circuit is coupled at M to the tuned plate circuit whence it draws its power, the retroaction coupling being at R.

The Marconi Company pioneered high-power valve transmission by installing a 200-kw. plant at Carnarvon in 1921, employing about 50 air-cooled valves for communication on 14,200 metres with Sydney, Australia. There are now several stations in existence which employ single water-cooled valves to deliver 100 kw. to the aerial. Also, a demountable 500-kw. valve has been produced by the Metropolitan Vickers Company, which operates quite satisfactorily.

Reception of Continuous-wave Signals. To produce a sound during the complete duration of the signal, continuous wave must either broken up into groups and so gi a group frequency, which metho known as *tonic train*; or, prefera beats must be produced in the c tinuous wave of a frequency to wh the telephone and the ear can respo The *beat generator* is simply a v oscillation generator of very power which is coupled to the ceiver aerial circuit, and induce current in it having a freque which is slightly mistuned to tha the incoming signal current so as produce the required beat. The b current is rectified, and is then i suitable form to produce an aud note in the telephone.

Wireless Telephony. The same m transmitting circuit is used as continuous-wave telegraphy to p duce "the carrier wave," or hi frequency electro-magnetic radiati on which is superposed the l frequency modulation correspond to the speech current wave-form p duced by the voice when speak into the microphone. The car wave may have any value within range of commercial wave-lengt actually as low as 50 cm. and as h as 10,000 metres, corresponding frequencies of 6×10^3 and $3 \times$ cycles per second. The speech curre contained a mixture of frequenc good commercial speech requiring frequency band of about 50 to 3 cycles per second, while music a good broadcast quality require a ba width to be extended to 10,000 cy per second.

A carbon granule microphone is instrument which consists of t carbon plates, one fixed to the s back of the instrument, the ot mounted on a mica diaphragm a free to vibrate with it. Between two carbon plates are loosely-pac granules of carbon. The electrical sistance of this arrangement is v sensitive to changes of pressure, a an electric current which is led through one carbon plate and through the other varies correspo ingly in strength as the voice produ vibrations of different frequency a amplitude in the mica diaphragm. is, however, essentially a low-curr instrument, and on this account only be inserted direct in the tra mitting aerial when the power of transmitter is very small.

In the method known as *grid c trol*, the variations of the direct c rent through the microphone cre corresponding E.M.F.'s in the sec dary of a transformer winding, whe they are applied directly to the g of the oscillating valve. A stron modulation is obtained by means

choke control" (fig. 9). Instead of modulating the grid potential of the oscillating valve O, it is the plate potential which is now altered. This requires an additional valve X, having a large iron core choke L_x in its plate circuit.

The first tests of a transatlantic radio telephone service connected to subscriber lines were carried out in 1926 at the Rugby transmitting station of the British Post Office, and Rugby has now become the world centre for radio telephone communications, the receiving stations being at Baldock and Cupar.

Broadcasting is the name given to the general dissemination of news and concerts by wireless telephony for popular amusement.

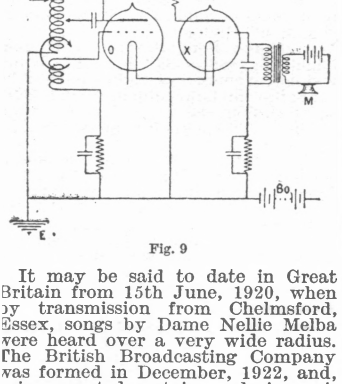


Fig. 9

It may be said to date in Great Britain from 15th June, 1920, when by transmission from Chelmsford, Essex, songs by Dame Nellie Melba were heard over a very wide radius. The British Broadcasting Company was formed in December, 1922, and, being granted certain exclusive privileges, gradually established regular systems of concerts and lectures from many stations. It was made compulsory for possessors of receiving sets to obtain a licence from the Post Office. By June, 1932, over 4,730,000 licences had been taken out. A public transatlantic telephone service was opened by the Post Office in January, 1927.

In the same month the British Broadcasting Company changed its name to the **British Broadcasting Corporation**, and received a Charter for ten years from the Postmaster-General.

The broadcast network in Great Britain now comprises one long wave National, five medium wave Regional, and one short wave Empire station, working on wave-lengths of 1554 metres, 200 to 550 metres, and 13 to 49 metres respectively.

Wave-lengths between 4 and 10 metres are now being investigated, and private enterprise has been responsible for much useful data concerning transmission and reception on 5 metres.

Still lower wave-lengths in the neighbourhood of 40-60 centimetres have been successfully used for communication over distances up to 160 miles by Marconi. These ultra short waves are focused into a beam by means of a parabolic reflector, and a remarkable saving in power is thereby obtained.

Broadcasting makes severe demands on the design of both transmitter and receiver. As regards transmission, in addition to the design of the transmitter itself, the technique of producing the programmes has necessitated high quality amplifiers and terminal equipment between microphone and transmitter, and a more or less complicated system of inter-communication between the various transmitters serving a territory.

The transmitter itself has to fulfil two major conditions:

(*a*) It must be capable of transmitting speech and music without distortion, i.e. modulation of the carrier wave between frequencies of, say, 50 cycles and 10,000 cycles must be effected without distortion.

(*b*) Its carrier frequency and the side band frequencies due to the modulation must be such as to afford the minimum of interference to other stations.

Excellent modulation is secured by the use of a microphone of the Reisz type, which is essentially a carbon granule microphone specially designed to give low background noise, or alternatively by a condenser type of microphone in which the vibrations set up by the air waves of speech in a thin stretched plate alter the capacity in the modulating circuit.

A receiver designed for Broadcast reception must:

(*a*) Be capable of reception of modulation of from 50 cycles to 10,000 cycles approximately.

(*b*) Possess sufficient selectivity to separate neighbouring transmitters without interference, i.e. it must possess sharply-tuned circuits, but not so sharply tuned as to cut off the higher sidebands of the transmission being received.

The advent of the moving-coil loud-speaker, which operates by the motion of a cone driven by a small coil vibrating in an intense magnetic field, has enabled music and speech to be faithfully reproduced.—BIBLIO-

GRAPHY: H. M. Dowsett, *Wireless Telephony and Broadcasting*; J. A. Fleming, *Principles of Electric Wave Telegraphy and Telephony*.

WIREWORM. A name given to the subterranean larvæ or grubs of click-beetles or skip-jacks. Common species are *Agriotes lineatus* and *Athous hæmorrhoidalis*.

WIRKSWORTH. A market town of Derbyshire, England. Pop. (1931), 3911.

WISBECH. A town and port of Cambridge, England, in the Isle of Ely, on the Nene. Exports are mainly of agricultural produce, particularly fruit, and imports are of coal and timber. Pop. (1931), 12,005.

WISBY, or VISBY. A seaport-city of Sweden, on the west coast of the Island of Gottland, at one time an important town in the Hanseatic League. Pop. (1932), 10,595.—**Laws of Wisby** are a collection of mercantile customs and regulations, dating from the last years of the thirteenth century. They were made the basis of the ordinances of the Hanseatic League. *See* INSURANCE (section *Accident or Casualty Insurance*).

WISCON'SIN. A river in the United States; it rises on the northern border of Wisconsin state, runs southward, becomes navigable at Portage City, and enters the Mississippi 4 miles below Prairie-du-Chien after a course of nearly 600 miles.

WISCONSIN. An East North Central state of the United States. It has a coast-line on Lake Michigan in the east, and a shorter one on Lake Superior in the north-west, and is generally a rolling plain, the highest points of the state being in the Penokee Range, and in Rib Hill (1940 feet) in the north. Wisconsin drains mainly to the Mississippi, the chief rivers being the St. Croix (forming western boundary for over 130 miles), Chippewa, Black, and Wisconsin (600 miles long); the Fox (250 miles) is the chief river flowing to Lake Michigan.

Climate, etc. The State is subject to tornadoes. The mean annual temperature is 44° F. (February, 15°; July, 70° F.), and the rainfall 32 inches. Madison is the State capital; other cities are: Milwaukee (the largest), Racine, Kenosha (pop. 1930, 50,262), Oshkosh (40,108), Superior, Green Bay, Sheboygan (39,251), and La Crosse (39,614). In 1931 there were 7399 miles of railways, in addition to 835 miles of electric railway track.

Production and Industry. Agriculture is the chief occupation, maize, wheat and other cereals, tobacco, sugar-beet, etc., being produce Orchard-fruits are raised, and dair ing, including the production cheese, butter, and condensed mil is very important. Sheep-rearing progressive.

Zinc is the chief mineral, followe by iron (hæmatite). There are sever mineral springs with a large outpu The Lake fisheries are prolific. Man factures are mainly connected wit the iron and steel industries.

People.—About 13·1 per cent of th population in 1930 was classed a foreign-born, and 33·2 per cent of thi number were German; Poles, Nor wegians, Czechs, Swedes, Russians Canadians, and English following i order. There were 11,705 Indian (1931) occupying reservations of 42 sq. miles.

Education. Elementary educatio is compulsory between the ages o seven and fourteen years, with a further period of continuation- or industrial-school training up to seven teen years of age. The State Univer sity is at Madison.

Area and Population. State area 56,066 sq. miles (810 sq. miles being water), exclusive of rights over 2378 sq. miles on Lake Superior and 7500 sq. miles on Lake Michigan. Pop. (1930), 2,939,006 (including 10,739 negroes).

Constitution. Winconsin was admitted to the Union in 1848. The Legislature is bicameral, comprising a Senate (33 members, elected fo four years, a proportion seeking re election biennially) and an Assembly (100 members, for two years). There are 69 counties. Two Senators and 10 Representatives are sent to Congress.

WISEMAN, Nicholas, Cardinal English Roman Catholic prelate born 1802, died 1865. He joined the English College then newly formed (1818) at Rome; became professor of Oriental languages and (1828 rector of the English College; re turned to England (1835), and was appointed successively rector o Ushaw, vicar apostolic of the centra district of England, and Roman Catholic Archbishop of Westminste (1850). He was the author of *Lectures on the Connection between Science and Revealed Religion* and *Recollections of the Last Four Popes*.

WISHART, George. Scottish re former and martyr, born in Kincar dineshire early in the sixteenth cen tury, died in 1546. Educated at Aberdeen, he travelled in France and Germany, where he accepted the Reformed doctrines; returned to Scotland and began to teach, but was prosecuted for heresy. In 1538

e fled to England, and remained Cambridge for six years; returned Scotland in 1543, and preached in he chief towns, for which offence, at he order of Cardinal Beaton, he was rrested in the house of Cockburn of rmiston, tried by a clerical assembly n St. Andrews, and burned at the take there.—Cf. C. Rogers, *Life of George Wishart, the Scottish Martyr.*

WISH'AW. Formerly a police burgh of Lanarkshire, Scotland, now united with Motherwell (q.v.). It has several large coal-mines, iron-, steel-, and nail-works, fireclay brick-works, railway-wagon works, a distillery, etc.

WISMAR. A seaport-town of Mecklenburg-Schwerin, on the Bay of Wismar, an arm of the Baltic Sea; served by rail to Rostock and Karow; the seaward terminus of the railway to Ludwigslust (pop. 6500). Machinery, paper, cement, asphalt, and sugar are made, and brewing and iron-founding are carried on. There is a large shipping trade in wood, coal, grain, paper, wine, stone, sugar, etc. Wendorf, a noted sea-bathing resort, lies about a mile north-west.

Acquiring the rights of a town in 1229, Wismar received extended privileges in 1266, fell to Mecklenburg in 1301, and was an important Hansa town. From 1648 until 1803 it was a Swedish possession, and was not definitely incorporated in Mecklenburg-Schwerin until 1897. Pop. (1925), 26,016.

WISSEMBOURG (Ger. *Weissenburg*). A frontier town of France, in the department of Bas Rhin; served by rail to Strasbourg, Lauterbourg, and Mainz. Matches, leather, paper, dye-stuffs, and beer are made, and there is a large lithographic establishment. Pop. 12,000.

WISTA'RIA. A genus of plants, nat. ord. Leguminosæ. The species are deciduous, twining, and climbing shrubs, natives of China and North America. Several (as *Wistaria chinensis*) have been introduced into England, and, when in flower, they form some of the handsomest ornaments of the garden. *W. frutescens* is a species belonging to the United States.

WITBANK. A coal-mining town in the Transvaal, South Africa, 60 miles east of Pretoria. Pop. 10,000 (3000 white).

WITCHCRAFT. A term applied to the supernatural power which persons were formerly supposed to obtain by entering into compact with evil spirits. The belief in witchcraft existed among all primitive nations, but it is also to be found in Babylonia and Egypt, and frequent references to witches are made in Holy Scripture. With the advent of Christianity the conception of witchcraft underwent a change.

Among the early Christians the doctrine of the active agency of the spirit of evil in human affairs became more fully developed than it had previously been. Satan was supposed to be in league with the vanquished gods of paganism, and witches were believed to have a compact with the dethroned gods and especially with Satan.

Like a nightmare the belief in witchcraft oppressed mankind from the thirteenth to the seventeenth century. The Roman Catholic Church and the Inquisition identified witchcraft with heresy, and witches were punished as idolaters and servants of Satan. By means of torture supposed witches were made to confess that they could ride through the air on brooms, and that they visited mountain tops and wild heaths where they held religious festivals, or Sabbaths, and celebrated the Black Mass.

In 1484 Innocent VIII. issued a Bull, ordering the severe punishment of witches, and soon after the form of proceeding was laid down in the famous *Malleus Maleficarum* (Hammer of Witches). No fewer than 100,000 victims must have suffered in Germany, and altogether over 300,000 suffered death in Europe.

The last trial for witchcraft in England took place in 1712, when Jane Wenham was convicted, and an execution took place in Scotland in 1722. Prosecution for witchcraft was abolished in the United Kingdom in 1736 by Act of Parliament. In America the last execution took place in 1692, and in France executions for witchcraft were prohibited by an edict of Louis XIV. in 1670. *See* DEMONOLOGY; MAGIC.—BIBLIOGRAPHY: H. C. Lea, *A History of the Inquisition of the Middle Ages*; W. E. H. Lecky, *History of the Rise and Influence of the Spirit of Rationalism in Europe*; W. Notestein, *History of English Witchcraft, 1558 to 1718.*

WITCHES' BROOM. An abnormal development of crowded twigs resembling a broom or crow's nest, produced on various trees by the attacks of parasitic fungi. The most familiar are those on silver birch due to *Exoascus turgidus*, but species of Exobasidium and certain *rust-fungi* cause similar malformations on other plants.

WITENAGEMOT, or **WITAN** (the meeting of the wise men). The council which advised the Anglo-Saxon kings. It was composed of archbishops, bishops, abbots, members of the

royal family, earls, and the small class of landowners known as King's Thegns. The Witan used to be credited with very extensive powers, including that of the election of the king, but later investigators admit that very little is known about the subject.

There is no information as to how often the Witan met, and it is impossible to define its functions, and its actual authority varied with the age of the monarch and with other circumstances in the national life.

The succession to the throne, from the time of Alfred to the Danish conquest under Canute, followed the rule of primogeniture, and it is probable that the "election" by the Witan was no more than acceptance or recognition of the succession of a sovereign. The term Witenagemot disappeared after the Norman Conquest, and the institution was replaced by the *Magnum Concilium*, which developed into Parliament.

WITHERITE. A colourless mineral formed of barium carbonate; specific gravity 4·3, nearly as high as that of barytes. It is mined at Fallowfield, in Northumberland, and is associated, like barytes, with veins of galena. It is used in chemical industries and as a rat-poison.

WITNEY. A market town of Oxford, England, noted for blankets. There is a bluecoat school and a free grammar-school. Pop. (1931), 3409.

WITTE, Sergius Yulievitsh, Count. Russian statesman, born 1849, died 1915. He came to the fore by organising the Russian railway-transport system during the Russo-Turkish War of 1877-8, and later (1892-3) succeeded Vishnegradski as Minister of Finance. By his vigorous and aggressive policy he almost doubled the imperial revenues, pushed forward the construction of railways, and introduced a State alcohol monopoly to stamp out drunkenness. In 1905 he went to Portsmouth (United States) as Russian delegate to the Peace Conference, and was made Count on his return. In 1903 he left the Ministry of Finance, and between 1905 and 1906 was Prime Minister. He was one of the ablest statesmen who ever assisted any Tsar.—Cf. his *Memoirs* (of which there is an English translation).

WITTENBERG. A town of Prussia, in the province of Saxony, on the Elbe; the junction of the Berlin-Weissenfels and Falkenberg-Rosslau railways. It was while Luther was a professor in Wittenberg that he nailed his ninety-five theses to the door of the Schlosskirche. The university of which he was professor was united to Halle in 1817. The principal buildings are the Schlosskirche, in which both Luther and Melanchthon are buried; the Stadtkirche, where Luther and Melanchthon preached; the remains of the Augustine monastery, with Luther's apartments; and the houses of Melanchthon and Cranach. Pop. 25,536.

WITTENBERGE. A town and river-port of Prussia, at the disemboguing of the Stepnitz into the Elbe; an important railway junction on the Hamburg-Berlin line (via Ludwigslust), for Lüneburg, Magdeburg (via Stendal), and Perleberg (pop. 10,000). Pop. 25,652.

WITWATERSRAND. *See* RAND.

WOAD. A cruciferous plant of the genus Isátis, the *I. tinctoria*, formerly cultivated to a great extent in Britain on account of the blue dye extracted from its pulped and fermented leaves. It is now, however, nearly superseded by indigo, which gives a stronger and finer blue. The ancient Britons are said to have coloured their bodies with the dye procured from the woad plant. *Wild woad*, *weld*, or *wold* is the *Reséda Luteóla*, a British plant, which yields a beautiful yellow dye. *See* DYER'S-WEED.

WOBURN. A city of Massachusetts, United States, in Middlesex county; served by the Boston & Maine Railway. Its manufactures are over 60 per cent leather, and it is the leather metropolis of New England. Settled in 1638, it became a city in 1888. Pop. (1930), 19,434.

WODAN, or **WODEN.** The Anglo-Saxon form of the name of the deity called by the Norse Odin (q.v.). *Wednesday* derives its name from him, and his name is also seen in several place-names, as *Wednes*bury, etc. *See* NORTHERN MYTHOLOGY.

WODEHOUSE, Pelham Grenville. English humorist and playwright, born at Guildford, 15th Oct., 1881; he was educated at Dulwich. For some years he was on the staff of *The Globe*. Since 1902, when he published *Pothunters*, at least one work has come from his pen every year. He is part author of 30 plays, among them *Kissing Time* and (with Ian Hay) *Leave it to Psmith*; among his stories are *Psmith in the City*, *Piccadilly Jim*, *The Inimitable Jeeves*, *Money for Nothing*, *Summer Lightning*, *Very Good, Jeeves and Hot Water* (1932).

WOKING. An urban district and town of Surrey, England, on the Wey. Brookwood and the London Necropolis (founded 1854) are near by. Pop. (1931), 29,927.

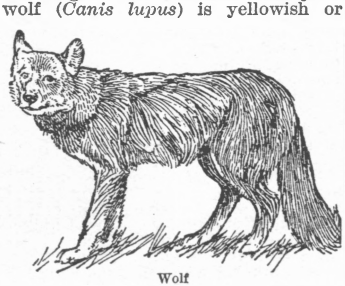
WOKINGHAM. A municipal borough of Berkshire, England, in Windsor Forest. It is an agricultural centre. Pop. (1931), 7294.

WOLCOT, John. British satirist, generally known by his nom-de-plume of "Peter Pindar," born in 1738, and died in 1819. Between 1778 and 1808 he is said to have put forth some sixty satirical productions in verse, most of them now forgotten.

WOLF, Friedrich August. German critic and scholar, born in 1759, died in 1824. His fame as a critic rests upon his *Prolegomena ad Homerum* (1795), in which he endeavours to show that the *Odyssey* and *Iliad* in their present form are not the work of one hand, but of several. Wolf's *Prolegomena ad Homerum* was not merely of importance in the history of Homeric scholarship. It introduced new ideas into criticism, and its influence was felt throughout classical and Biblical scholarship.

WOLF, Hugo. Viennese composer. He was born at Windischgrätz (Styria), 13th March, 1860, and studied music at the Vienna Conservatorium. His work was done under the handicap of dire poverty and towards the end of his life of brain disease, which culminated in insanity. His fame as a composer rests on his songs, which number nearly 500. The best of them represent the *lied* in perfection, and their supremacy is increasingly recognised. He died 22nd Feb., 1903.

WOLF. A mammal belonging to the digitigrade carnivora, family Canidæ, and very closely related to the dog. The common European wolf (*Canis lupus*) is yellowish or



Wolf

fulvous grey; the hair is harsh and strong, the ears erect and pointed, the tail straight, or nearly so, and there is a blackish band or streak on the forelegs about the carpus. The height at the shoulder is from 27 to 29 inches.

WOLFE, Charles. Author of the *Ode on the Burial of Sir John Moore*, born in Dublin 1791, died 1823. He was educated at Trinity College, Dublin, and it was while there that the poem which has secured his fame was published in *The Newry Telegraph* (1817). He was also the author of several other poems, and his *Remains* were published at Dublin (2 vols., 1825).

WOLFE, James. British soldier, born at Westerham, Kent, in 1727, died in 1759. He entered the army and proceeded with his regiment to the Low Countries; took part in the battles of Dettingen, Fontenoy, Falkirk, Culloden, and Laffeldt, and, after distinguished service against the French in America, he was entrusted (1759) with an army of 8000 men with which to assault Quebec.

During the night this small force scaled the Heights of Abraham, which commanded the town, and in the battle which took place next day the British were victorious; but General Wolfe was wounded in the engagement, and died in the moment of victory, his opponent, Montcalm, being also mortally wounded.

WOLFENBÜTTEL (vol'fén-bût-l). A town of Brunswick, Germany, on the Oker; a junction on the railway Jerxheim-Brunswick, for Harzburg. A library of about 300,000 volumes, besides MSS., and a statue of Lessing, who was long librarian to the duke, are notable features. Pop. 18,479.

WOLFFIA. A genus of water-plants, order Lemnaceæ. *W. arrhiza*, the only British species, is the smallest known flowering plant, its fronds being only $\frac{1}{20}$ inch in diameter.

WOLFFIAN BODIES (after *Wolff*, the discoverer). In physiology, a term applied to certain bodies in the vertebrate embryo, preceding the two kidneys, whose functions they perform. As the fœtus develops they gradually disappear, their place being supplied by the true kidneys, except in fishes, in which they are permanent.

WOLFRAM (*wolframite* of American writers). A mineral formed of iron and manganese tungstate, the principal source of tungsten. It occurs in association with granite veins, commonly with tin ores, in dark-brown or black monoclinic crystals, often of large size. Attention is called to it by its high specific gravity, 7·4. The variety poor in manganese and rich in iron is called *ferberite*. *Hübnerite* is almost pure manganese tungstate. Both these minerals are isomorphous with wolfram. The modern demand for tung-

sten has given importance to the wolfram of the Cornish tin-mines.

WOLF'S-BANE. A poisonous plant of the genus Aconitum (*A. Napellus*). It is a native of Alpine pastures in Switzerland, and found in a wild state in one or two parts of England. *See* ACONITE.

WOLLASTON, William Hyde. English chemist and physicist, born in London 1776, died 1828. He was the inventor of the goniometer, an instrument for measuring the angles of crystals, and the discoverer of palladium and rhodium, and the malleability of platinum.

WOLLASTONITE. One of the mineral group known as pyroxenes, crystallising in the monoclinic system, typically in broad, flat, colourless crystals, whence it has been called *tabular spar*. It is a calcium metasilicate, and is common in limestones that have been altered by the intrusion of a granite magma.

WOLLIN (vol'in). An island and town of Prussia, at the mouth of the Oder, on the north side of the Great Haff; length, 20 miles; breadth, from 3 to 10 miles. Fishing and cattle-rearing are the chief employments. Pop. (town), 5000.

WOLSELEY (wŭl'li), **Garnet Joseph, first Viscount.** British soldier, born 1833, died 1913. He entered the army as ensign in 1852; took part in the second Burmese War (1852-3), where he was severely wounded; served with distinction in the Crimea, and was wounded at the siege of Sebastopol; engaged in the siege and capture of Lucknow during the Indian Mutiny of 1857-8; and was employed in 1860 in the Chinese War. He was dispatched to Canada in 1861, and again in 1867, having received command of the Red River expedition, which he carried to a successful issue.

Three years afterwards Wolseley was appointed to the command of an expedition to punish the King of Ashanti, and after a brief campaign he entered Coomassie (Feb., 1874) and received the submission of the king. After the defeat of a British force by the Zulus in South Africa in 1879 he was dispatched as High Commissioner, but before his arrival the Zulus had been defeated at Ulundi, and little remained for him to do.

His next command was in Egypt in 1882, where his forces successfully stormed the lines of Tel-el-Kebir and captured Arabi Pasha. When the Mahdi subdued the Sudan, and held General Gordon prisoner in Khartum, Wolseley was dispatched in 1884 with a relief expedition. He concentrated his forces at Korti, and sent a column across the desert to Khartum, but the place had fallen. In 1885 he was created a viscount, from 1890 to 1895 was Commander-in-Chief in Ireland, in 1894 made field-marshal, and was Commander-in-Chief of the army from 1895 to 1900. He was awarded the Order of Merit in 1902.—Cf. *The Story of a Soldier's Life*, an autobiography.

WOLSEY (wŭl'zi), **Thomas.** English cardinal and statesman, said to have been the son of a butcher, born at Ipswich in 1471, died in 1530. He was educated at Magdalen College, Oxford. After quitting the university he was appointed to the parish of Lymington, in Hampshire. Then he became a private chaplain to the Archbishop of Canterbury, one of the governors of Calais, chaplain to Henry VII., and Dean of Lincoln.

When Henry VIII. became king the advancement of Wolsey was rapid. Successively he was appointed Canon of Windsor, Dean of York, Bishop of Lincoln, Archbishop of York, and his nomination as cardinal in 1515 and Pope's legate in 1518 completed his ecclesiastical dignities. In 1515 he was also appointed Lord Chancellor of the kingdom. He was twice a candidate for the Papacy, and his power in England, as also his revenues, were only equalled by those of the Crown.

This rapid preferment by the king was largely the result of a remarkable series of diplomatic victories, in which Wolsey had been the means of enabling Henry to hold the balance between Francis I. and the Emperor Charles V. His success in the region of politics terminated in the splendours of the Field of the Cloth of Gold (1520). In his ambitious career the cardinal had made many enemies, who were held in check so long as he retained the favour of his royal master. This favour Wolsey lost when he failed to obtain from Pope Clement a decision granting the king's divorce from Catharine of Aragon.

Thenceforth the enemies of the fallen prelate harried him unmercifully. He was banished from court, stripped of his dignities, found guilty of a præmunire, and sentenced to imprisonment. Finally, after a brief respite, during which he was restored to some of his offices and had returned to his see of York, he was arrested at Cawood Castle on a charge of high treason, and on his way to London as a prisoner he died of dysentery at Leicester Abbey.—BIBLIOGRAPHY: Mandell Creighton, *Cardinal Wolsey*; E. L. Taunton,

Cardinal Wolsey; J. S. Brewer, *Reign of Henry VIII.*

WOLVERHAMPTON. A municipal and county borough of Staffordshire, England. It is situated in the heart of the Midland mining district, has extensive beds of coal and ironstone in its vicinity, is the largest manufacturing town in Stafford, and is known as the capital of the Black Country. The chief industries are the smelting of iron ore and its conversion into all forms of ironware, and manufactures in brass, tin, steel, papier-mâché, galvanised iron, and chemicals. Pop. (1931), 133,190.

WOLVERTON. Urban district of Buckinghamshire. It is on the Great Ouse, 52 miles from London, and is an important point on the L.M.S. Railway, which has works at New Wolverton. Pop. (1931). 12,870.

WOMBAT (*Phascolomys wombat*). A marsupial animal, a native of Australia and Tasmania. It is about 3 feet in length, and has coarse, almost bristly fur, of a general grey tint, mottled with black and white. It burrows, feeds on roots, and its flesh is said in fatness and flavour to resemble pork.

WOMBWELL. An urban district of Yorkshire, England, in the West Riding, on the Dove. It has coal-mining and iron-working industries. Pop. (1931), 18,365.

WOMEN SUFFRAGE. Exercise of the vote in parliamentary and municipal elections by women. Advocated in the middle of the nineteenth century by Cobden, Mill, and Disraeli, the societies formed to promote it were united in a National Union in 1887 under Mrs. Henry Fawcett. In 1903 the Women's Social and Political Union was formed under Mrs. Pankhurst (q.v.), and soon developed militant tactics. In 1906 the Liberal party came into power under Asquith, who was a violent opponent of the cause. **Suffragettes,** as women suffragists were called, heckled members of Parliament, and held demonstrations. They were sent to prison, and went on hunger-strike. During the European War they showed such ability and unsuspected powers of citizenship, that in 1916 a conference decided that women over thirty years old who were householders, or wives of householders, should be allowed to vote, and this was passed by Lloyd George's Government in June, 1917. In 1918 the Act making women eligible to sit in Parliament was passed, and in 1919 Viscountess Astor was the first to take her seat. In 1928 a Bill was passed giving complete political equality to women.

In all the Dominions, except South Africa, women suffrage is in force, and in most countries, except France, Italy, and Spain.

WOOD, Anthony. English antiquary, born at Oxford in 1632, died in 1695. He was educated at Merton College, Oxford, where he took his degrees, and spent his life in examining and sifting the records of the university. The result of his laborious researches was published as *Historia et Antiquitates Universitatis Oxoniensis* (1674), this being a Latin translation of Wood's English treatise under the authority of the university. He was also the author of *Athenæ Oxonienses* (1691-2).

WOOD, Ellen, or **PRICE.** English novelist, better known as Mrs. Henry Wood, born at Worcester 1814, died 1887. Among her many novels may be noted *East Lynne*, which has had an enormous success both as a book and a drama; *The Channings*; *St. Martin's Eve*; *A Life's Secret*; *Roland Yorke*; *Dene Hollow*; and the *Johnny Ludlow Stories*, reprinted from the *Argosy*, of which she was long editor.

WOOD, Sir Evelyn. British soldier, born in 1838, died in 1919. Educated at Marlborough College, he entered the navy in 1852, and served with distinction in the Crimean War. In 1855 he joined the army as cornet in the 13th Dragoons, and in the mutiny campaign in India in 1858 he served with the 17th Lancers, gaining the V.C. After going through the Ashanti War he was called to the Bar at the Middle Temple in 1874.

For his brilliant conduct in the Zulu War of 1879 he was promoted brigadier-general and created K.C.B. He was second in command of the British forces in the short Transvaal War of 1881, and in 1884-5 he commanded the line of communication in the Nile expedition. He was made G.C.M.G. in 1882, G.C.B. in 1891, and field-marshal in 1903. His publications include: *The Crimea in 1854 and in 1894*; *Cavalry in the Waterloo Campaign*; and *From Midshipman to Field Marshal* (1906), an autobiography.

WOOD, Sir Henry Joseph. English conductor. He was born in London, 3rd March, 1869, and since 1895 has conducted the Queen's Hall Promenade concerts, and since 1897 the Sunday orchestral concerts in London. He has also conducted the Norwich, Sheffield, Birmingham, and other musical festivals, and has not only raised the standard of musical taste in England, but has secured a hearing

for many modern composers, British or foreign. He was knighted in 1910.

WOOD, Sir Howard Kingsley. English politician; born in 1881, he started active life as a solicitor, and served for some years on the L.C.C. Unionist M.P. for Woolwich West since Dec., 1918, when he was knighted; he was Parliamentary Secretary to the Ministry of Health, Nov., 1924 to June, 1929, and in Nov., 1931, became Postmaster-General, a position he still held in 1933. He is an authority on insurance and housing.

WOODBRIDGE. A town and river-port of Suffolk, England, on the River Deben. Pop. (1931), 4734.

WOOD-CHUCK. The popular name of a rodent mammal, a species of the marmot kind and of the squirrel family (Sciuridæ), the *Arctomys monax*, or ground-hog, common in the United States and Canada. It is of a heavy form, from 15 to 18 inches long, blackish or grizzled above and chestnut-red below. It digs out burrows in which it passes the winter in a dormant state.

WOODCOCK. A bird of the plover family and genus Scolŏpax, the *S. rusticula*, allied to the snipes (Gallinago). It is widely distributed, being found in all parts of Europe, the north of Asia, and as far east as Japan. It is a game-bird of Britain, where it is known chiefly as a winter visitant, but also breeds in certain districts.

The bird is about 13 inches in length, the female being somewhat larger than the male. Its food is chiefly worms. Related species are native to Java and New Guinea (*S. saturata*) and the Moluccas (*S. rochusseni*). The woodcock of eastern North America (*Philohela minor*) is a smaller bird, but very similar in plumage and habits.

WOOD-LARK. A small species of lark, the *Alauda arborea*, found in Britain. Its song is more melodious than that of the skylark, but it does not consist of so great a variety of notes, nor is it so loud.

WOODPECKER. A name for the climbing birds belonging to the family Picidæ, and the order Coraciiformes. The family has a very wide distribution, but is not represented in Egypt, Madagascar, and the Australian region. Woodpeckers are characterised by their long, straight, angular beak, adapted for splitting the bark of trees; by their slender tongue, with its spines at the tip curved backwards to enable them to extract insects from crevices; and by their stiff tail, which acts as a prop to support them while climbing.

The noise they make in tapping the bark of a tree to discover where an insect is lodged can be heard at a considerable distance. *Dendrocopus major* and *D. minor* are European species, but the best known in Britain is *Gecinus viridis*, the green woodpecker or yaffle. The first mentioned, the great spotted woodpecker, is coloured black and white, with a scarlet crown; length, 8 to 9 inches. The great black woodpecker (*Picus martius*) ranges through the pine forests of Europe and Asia to Japan. In America the most characteristic

Greater Spotted Woodpecker

species are *Campephilus principālis* or the ivory-billed woodpecker, *Colaptes aurātus* or gold-winged woodpecker and the Californian woodpecker (*Melanerpes formicivŏrus*).

WOODS AND FORESTS, COMMISSION OF. A British Government department under two Commissioners (one of whom is the Minister of Agriculture and Fisheries) which assumed its present form in 1919, but dates back to 1760, when George III. surrendered the land revenues from Crown lands in return for a Civil List.

The Commission now holds over 800,000 acres of land (including the Crown Woods, transferred in 1924), and of this 211,674 acres have been planted. The acreage planted in 1932 alone was 22,663. A large sum annually finds its way to the Imperial Exchequer from the surplus revenues of the Commission of Woods, Forests, and Land Revenues.

WOODSTOCK. A borough of Oxfordshire, England, a glove-making centre. Pop. (1931), 1484.

WOODSTOCK. A town and port of entry of New Brunswick, Canada, in Carleton county; served by National and Canadian Pacific Railways. It is an agricultural centre, with an agricultural college. Pop. 3259.

WOODSTOCK. A town of Ontario, Canada, in Oxford County, and on Thames River; served by the National and Pacific railways, and by electric railway to Ingersoll. It is the seat of Woodstock College, and is a busy manufacturing town, the centre of an agricultural district. Pop. 11,395.

WOOD-SWALLOW. A name given in Australia to a genus of birds (*Artămus*), family Artamidæ. One species (*A. sordidus*) is remarkable for its habit of hanging suspended from dead branches in clusters resembling swarms of bees.

WOOD-TAR is obtained as a by-product in the destructive distillation of wood. The tar which collects below the heaps in which charcoal is burned is a thick dark-coloured liquid with a strong creosote-like smell. It contains paraffins, resins, and also phenols and phenolic ethers.

Wood-tar obtained from the distillation of wood in retorts has similar properties, but is more fluid and contains a higher proportion of paraffins. The colour of the tar varies from light brown to almost black, according to the variety of wood used. On distilling the crude tar, fractions known as light and heavy tar oils are obtained. Wood-tar is used for preserving rope, wood, felt, etc., and also in the preparation of creosote (q.v.).

WOOLLEN MANUFACTURE. The conversion of wool fibres into yarn-like form by rudimentary processes is probably conducted more easily than the somewhat analogous conversion of vegetable filaments, and hence wool fibres would probably be used for such purposes before any other of the present-day textile fibres. Modern methods of converting wool fibres into woollen or worsted yarns and cloth are as intricate as those which are practised for the conversion of any other fibre into textile products.

Wool has been used in these islands for a great number of years, and several conditions have contributed to the ultimate establishment of the chief centres of the woollen industry. Possibly three-quarters, or even more, of the entire British woollen and worsted industry is centred in the West Riding of Yorkshire, where the chief seats are Bradford, Leeds, Huddersfield, Halifax, and Keighley (and the small towns and villages adjoining these places), and the so-called "Heavy Woollen District," which includes Dewsbury, Batley, Moreley, Ossett, Mirfield, Heckmondwike, Birstal, Guiseley, Yeadon, etc.

The remainder of the industry is spread over districts which are situated in the south of Scotland (Galashiels, Hawick, Selkirk, etc.), west of Scotland (Glasgow and district, Ayrshire, etc.), the west of England (Stroud, Trowbridge, etc.), the midlands of England (Leicester, etc.), and parts of Wales and Ireland.

The production of woollen yarn for woollen goods is quite distinct from that for worsted yarns, although both kinds of yarn are made from wool fibres. The wool staplers clip, sort, and classify the locks of wool from several different parts of the fleece, and supply many manufacturers with the raw material.

Large firms of manufacturers employ their own wool sorters. The fleece of wool is spread on an open-mesh wire riddle which is raised about 6 inches from an open drawer, and the latter, as well as the riddle, is supported by a table or stand. During the process of clipping and sorting, most of the foreign matter—dirt, sand, and the like—passes through the riddle into the open drawer. The sorted wool in the unwashed state contains a natural grease termed yolk or suint, and this, in addition to any dirt which remains after sorting, is wholly or partially removed by means of a specially designed machine termed a wool-scouring machine.

Here the fibres are fed to the feed rollers, and caused to pass through a mild alkaline bath by means of suitable propellers and grates. As the wool emerges at the opposite end of the machine, it is squeezed between rollers, and afterwards dried by automatic drying machines or other means. In spite of the gentle treatment in the wool-scouring and drying machines, the fibres have a natural tendency to adhere to each other, so it is usual to pass the dried material through a teasing machine, which disentangles the fibres and removes most of the dirt which may have escaped removal in the preceding processes.

If the wool contains burrs (sharp-pointed seeds), they are removed either by the burring machine or by a carbonising process. The teased wool may be used alone, or, as is often the case, mixed with other qualities of wool, or even with other textile fibres, to form a mixture or "blend." The necessary quantity of each material is laid in horizontal

layers, one above the other, on the floor of the willey-house, each layer being oiled unless the oiling is to be done automatically in the tenter-hook willey or "fearnought."

This machine really performs a preliminary carding action, as it is provided with a cylinder, workers, and strippers, each roller being covered with teeth. The operative takes vertical sections from the blend or pile and spreads them on the feed table of the willey; the table conveys the fibres to the nip of the rollers, which carry the material to the above-mentioned group of rollers, and the latter card the fibres slightly, open them, and ultimately convey them to the delivery side, where they are blown into a closed-in compartment usually formed by hessian cloth.

The real carding action takes place in the next machine, termed a scribbler; this machine is provided with two or more cylinders, and on approximately half the periphery—the upper half—of each are the workers and strippers, while at intermediate stages are the angle strippers, fancy, and doffers. Each roller is covered with fine card clothing (thousands of bent wires, the free ends of which manipulate the fibres in various ways). The treated fibres are doffed in the form of a thin sheet, and this sheet has to be delivered to the condensing machine.

In some cases the thin sheet is formed into a lap, or it may be contracted to the form of a sliver; but in every case the material is conveyed, invariably automatically, from the scribbler to the condenser, where the material is further treated and separated into narrow strips, about 1½ inches wide, either by a tape condenser, by single-ring doffer, or by double-ring doffer, each doffer taking alternate narrow widths from the sheet.

Finally, the separated narrow strips are passed between and rubbed or rolled by pairs of endless rubbers, and then in their rounded form, termed slubbing or rove, are wound on to wide condenser bobbins. These bobbins, each of which contains from twenty to forty slubbings, are taken to the creel of the spinning mule (q.v.). After the yarn is spun on the mule into warp and weft, warps, or chains are made from the warp and beamed on to the weaver's beam. Then both warp and weft are interwoven in the well-known way to form various kinds of cloth.

When the cloth leaves the loom, it is perched, knotted, mended, milled or felted in milling machines or in fulling stocks, washed, hydro-extracted, tentered or dried, raised, brushed, cut or cropped, steamed, pressed, etc., according to requirements. Lastly, the piece is burled, and if any damages are present, they are repaired by a fine-drawer.

The above processes from perching onwards refer mostly to the operations conducted on army, navy, and police clothing, doeskins, pilots, beavers, and the like. Napping and witneying machines are also used for certain kinds, and numerous other finishes are applied according to the effect required in the finished fabric.

Processes involving dyed material in fibre form, yarn state, or in piece goods are naturally extensively practised, because coloured goods in woollen form by far the bulk of the trade. When pieces are dyed, several of the above processes of finishing have to be performed after the cloth leaves the dye-house. — BIBLIOGRAPHY: A. F. Barker, *Woollen and Worsted Spinning*; J. W. Radcliffe, *The Manufacture of Woollen and Worsted Yarns*; H. Priestman, *Principles of Woollen Spinning*.

WOOLLEY, Frank Edward. English cricketer, born at Tonbridge, 27th May, 1887, he joined the Kent team as a professional in 1906. A left-handed batsman, his style of play is remarkably attractive, and he has been a very useful bowler. In seven seasons he has taken over 100 wickets for Kent, and he is one of the few batsmen who have scored over 100 centuries. In 1928 he scored 3352 runs. Woolley has played for England against Australia and has been to Australia several times.

WOOLNER, Thomas. British sculptor; born at Hadleigh, Suffolk, 1825, died 1892. He studied under William Behnes, and exhibited his first notable life-size group, *The Death of Boadicea* in 1844. This was followed by *Puck*, *Titania*, and *Eros and Euphrosyne*. Besides his well-known statues of Carlyle, Tennyson, Gladstone, Newman, Darwin, Kingsley, etc., his more celebrated works are: *Elaine with the Shield of Sir Lancelot*, *Ophelia*, *In Memoriam*, *Virgilia bewailing the Banishment of Coriolanus*, and *Achilles and Pallas shouting from the Trenches*. Woolner also achieved some success as a poet.

WOOLSACK. A large square bag of wool, without back or arms, covered with red cloth, which forms the seat of the Lord Chancellor of England in his capacity of Speaker of the House of Lords. It is said to have been placed in the Upper House in the reign of King Edward III. to remind the peers that the wool trade was England's staple industry.

WOOLWICH (wŭl'ich). A metropolitan municipal and parliamentary borough of England, on the Thames, 8 miles below London Bridge. It stretches about 3 miles along the south bank of the river, and owes its importance to the great arsenal, which has a circumference of 4 miles, and comprises gun- and carriage-factories, forges, foundries, workshops, laboratory, barracks, etc., with vast magazines of warlike stores. Woolwich is also the headquarters of the Royal Military Academy for training officers for the artillery and engineers. North Woolwich, with various industries, on the north side of the river, is connected by steam ferry. Pop. (1931), 146,944.

WOOLWORTH, Frank Winfield. American merchant, born near Rodman, New York, 13th April, 1852, after two failures he opened a 5, 10, and 15 cent store in New York City. In a few years he had hundreds of branches all over the States, and by 1912 had grown rich enough to erect the Woolworth Building in New York, at that time the highest commercial building in the world. His stores have spread over England and Scotland and are to be found in several Continental capitals. He died 8th April, 1919, worth $27,000,000.

WOONSOCKET. A city of Rhode Island, United States, in Providence county, on Blackstone River; served by the New York, New Haven, & Hartford Railway. Its manufacturing establishments include cotton- and woollen-factories, machine-shops, rubber-works, and iron-foundries. Pop. (1930), 49,376.

WORCESTER. The county town and a county of a city of Worcestershire, and one of the most ancient cities of England, on the Severn. Its most notable building is a Gothic cathedral, originally built in 680 and rebuilt in the beginning of the thirteenth century. Among other buildings are the shire hall, the guildhall, corn exchange, museum of natural history, etc. Worcester is the chief seat of the English leather glove trade, has porcelain-works, sauce-works, foundries, carriage-factories, and other works. Pop. (1931), 50,497.

WORCESTER. A town of Cape Province, South Africa, 59 miles N.E. of Capetown. It is a centre of viticulture and of wine and brandy production. Pop. (1931), 4781 (Eur.).

WORCESTER. A city of Massachusetts, United States, on Blackstone River; served by the Boston & Albany Railway. Clark University is here. It is an important educational and manufacturing centre. Steel-works, the making of wire rope, and hardware, provide the chief employments. It was settled in 1684. Pop. (1930), 195,311.

WORCESTER COLLEGE, Oxford. Originally called Gloucester Hall, was founded in 1714 by Sir Thomas Cookes of Bentley, Worcestershire.

WORCESTERSHIRE. A county of England. It is bounded north by Shropshire and Staffordshire, east by Warwickshire, south by Gloucestershire, and west by Herefordshire; area, 447,678 acres. The surface is a broad plain varied by the Malvern Hills in the south-west, several valleys, of which the Severn is the most notable, and having as its chief rivers the Severn, Stour, Teme, and Avon. The soil, which is mostly of clay, is well adapted for wheat, which is extensively grown, while hop gardens are numerous.

Coal and iron are worked in the Dudley district; there are large manufactures of iron, steel, and hardware; and salt is obtained from the salt springs at Droitwich. The carpets of Kidderminster are famous, as are also the gloves and porcelain of Worcester, and there are important glass manufactures at Dudley and Stourbridge. Pop. (1931), 420,156.

WORDSWORTH, Dorothy. English writer, sister of the poet William Wordsworth. Born in 1771, she was the devoted companion of her brother, and is believed to have assisted him in his studies of nature and rustic life. She herself left some valuable *Journals*, and the *Recollections of a Tour in Scotland*, published in 1803. She died in 1855.

WORDSWORTH, William. English poet; born on the 7th April, 1770, and died on the 23rd April, 1850. He was a son of John Wordsworth (1741-83), a prosperous attorney of Cockermouth, and law-agent to James Lowther, first Earl of Lonsdale (creation of 1784). The other children of John Wordsworth were Richard (1768-1816); Dorothy (1771-1855), William's devoted companion, and celebrated for her *Journal*; John (1772-1805), drowned at sea; and Christopher (1774-1846), subsequently master of Trinity College, Cambridge, and one of the founders of the classical tripos.

Other distinguished members of the family are Christopher's sons, Christopher (1807-85), who was headmaster of Harrow (1836-44) and became Bishop of Lincoln in 1869; Charles (1806-92), who became warden of Trinity College, Glenalmond (1846-52), and Bishop of St. Andrews, Dunkeld, and Dunblane; and John

(1843-1911), son of the Bishop of Lincoln, who became Bishop of Salisbury in 1885.

Wordsworth was educated at schools at Cockermouth and Penrith, and at the age of eight went to the grammar-school at Hawkshead, where he chiefly appreciated the freedom from supervision. He read many of the best authors, Cervantes, Le Sage, Swift, and Fielding, and mastered the *Arabian Nights* in an abridged edition. He was an active boy, and delighted in fishing, boating, riding, walking, skating, and every form of exercise.

When his father died, the poet was thirteen years of age, and was put in the charge of guardians, who sent him to St. John's College, Cambridge, in 1787. His time at Cambridge was not profitably spent, and he took a poll-degree in 1791. The outstanding feature of his college days was a Continental trip which he took during the long vacation of 1790 with his friend Robert Jones.

While in France, he laid the foundations of his short-lived republican ardour. In 1791 and 1792 he again went abroad, on the pretext of learning enough French to qualify him for the post of travelling tutor. He visited Paris, Orleans, and Blois, and almost threw his lot in with the Girondins.

He returned to England in Dec., 1792, and for some years led a desultory life, obstinately refusing to follow a definite profession.

Early in 1793 he published his *Evening Walk* and *Descriptive Sketches*. These poems are immature and conventional, but they contain vivid pictures of nature, drawn by one who evidently believed in the educative value of " One impulse from a vernal wood." In the same year he wrote a prose letter to the Bishop of Llandaff, who had attacked the revolution. A timely legacy of £900 from a friend, Raisley Calvert, permanently removed Wordsworth from the danger of having to enter the Church or the legal profession.

In 1795 he settled with his sister at Racedown, in Dorsetshire, where he wrote some Juvenalian satires which he suppressed, and a tragedy, *The Borderers*, a typical closet-drama, not published until 1842. He was gradually casting the slough of his republican opinions, but the process was a slow and somewhat painful one.

In 1795 he met Coleridge; their meeting had a far-reaching effect upon the work of both. In 1797 Wordsworth moved to Alfoxden, in Somersetshire, in order to be near Coleridge, who was then living at Nether Stowey. They were visited by Lamb and Hazlitt.

In Sept., 1798, Wordsworth and Coleridge published jointly their famous *Lyrical Ballads*, " for money and for money alone," as Wordsworth himself said. Wordsworth supplied the bulk of the poems; *The Ancient Mariner* and three other poems are the work of Coleridge. The authors received thirty guineas for the book, but its sale was slow, and each of them blamed the other for its ill-success.

It contained some of Wordsworth's best work, such as *We are Seven*, *Simon Lee*, and *Lines composed a few miles above Tintern Abbey*, but it also contained some feeble and prosaic effusions. In 1798 the Wordsworths settled at Goslar, in Germany, with the intention of studying German and natural science. They returned to England after six months without having acquired much of either. They had been prepared to stay two years. Late in 1799 they settled at Dove Cottage, Grasmere, where Wordsworth steadily laboured in his vocation.

A second edition of *Lyrical Ballads* appeared in 1800, with a famous preface by Wordsworth, who stated therein his theory of poetic diction, asserting that " there is no essential difference between the language of prose and metrical composition." Wordsworth certainly had a strong case against the diction of much contemporary poetry, a diction which was almost as corrupt and absurd a jargon as the " law-French " of the seventeenth century. Like most advocates, however, he overstated his case, and was led into a paradoxical and unwarrantable eulogy of the language of rustics, thereby laying himself open to much ridicule.

In 1802 the Earl of Lonsdale, who had refused to pay his debts to the Wordsworth family, died, and his heir honourably discharged his obligations. Wordsworth and his sister each received about £1800; on the strength of this Wordsworth, in Oct., 1802, married Mary Hutchinson, whom he had known all his life. Dorothy still remained a member of his household.

Wordsworth had visited Scotland in 1801, and went there again in 1803 with his sister and Coleridge, visiting the Burns country and making the acquaintance of Scott. Dorothy Wordsworth's *Recollections of a Tour made in Scotland, A.D. 1803* was edited in 1874 by Principal Shairp of St. Andrews.

In May, 1805, Wordsworth finished *The Prelude, or Growth of a Poet's Mind*, a poem which was intended to bear the same relation to *The Recluse* that " the Ante-chapel has to the body of a Gothic Church." *The Recluse* was to be " a philosophical

poem, containing views of Man, Nature, and Society," and owed its name to the fact of its "having for its principal subject the sensations and opinions of a poet living in retirement." The first book of the first part of *The Recluse* was written, but not published until 1888; the second part, *The Excursion*, was completed and published in 1814; the third part was only planned.

In 1807 Wordsworth published a collection of poems in two volumes, including the *Ode to Duty*, the *Intimations of Immortality from Recollections of Early Childhood*, *Miscellaneous Sonnets*, *Sonnets dedicated to Liberty*, and other poems. In 1809 he published a pamphlet *Concerning the Relations of Great Britain, Spain, and Portugal to each other, and to the Common Enemy, at this Crisis*. It was written in an eloquent but involved style; the complexity of Wordsworth's prose is a striking contrast to the simplicity of his poetry.

Wordsworth had moved from Dove Cottage to Allan Bank in 1808, and had gone to the parsonage at Grasmere in 1810. Early in 1813 he moved to Rydal Mount, where he lived until his death. In 1813 he was made Distributor of Stamps for the county of Westmorland, an office which brought him in about £400 a year. His duties were light.

In 1814, the year in which *The Excursion* appeared, he visited Scotland again. *The White Doe of Rylstone* appeared in 1815, *Peter Bell* and *The Waggoner* in 1819, and *Ecclesiastical Sketches* in 1822. By this time Wordsworth had published his best work; the rest of his life, save for some travels at home and abroad, was uneventful. He travelled on the Continent in 1820, 1823, 1828, and 1837, in Ireland in 1829, in Scotland in 1831 (visiting Scott and writing *Yarrow Revisited*), and again in 1833.

Many of Wordsworth's friends died long before he did, and he felt keenly the deaths of Scott (1832), Coleridge (1834), and Lamb (1834). His beloved sister Dorothy was extremely ill in 1829, and never regained her health, though she lived twenty-six years longer with impaired mental faculties.

Wordsworth's importance as a poet was recognised after the publication of Coleridge's *Biographia Literaria* in 1817, and was acknowledged more and more widely as time went on. In 1838 he was made an honorary D.C.L. of Durham; in 1839 he received the same degree at Oxford, and was enthusiastically welcomed. In 1842 he resigned his place in the Stamp Office, and was granted a Civil List pension of £300.

After the death of Southey (1843) Wordsworth was made Poet Laureate; he would not have accepted the post if he had not thought that the duties were purely nominal. His one official poem was probably written by his son-in-law. Wordsworth died peacefully at Rydal Mount in 1850, and was buried in Grasmere Churchyard. His poetic laurels, "greener from the brows of him that utter'd nothing base," fell to the lot of Tennyson.

Wordsworth had unique gifts as a poet; but the story of his mental development is a more or less commonplace one. To change from republicanism and heterodoxy to conservatism and the Church of England has been the experience of many. His beliefs, however, are of less value than his analysis of how he acquired them, although some readers care less for the means than for the end in such matters. He has given us a most valuable picture of the growth of a poet's mind; with all reverence it may be said that in almost all his best poems the bard is the hero of his story.

In the notes upon the composition of his poems Wordsworth has prevented foolish conjectures at the expense of giving a good deal of irrelevant detail, and disillusionising his readers much as Trollope (q.v.) afterwards did. In his formal attacks upon poetic orthodoxy—his prefaces, etc.—he did not state his case very clearly, and was led into a paradoxical side-issue. His theory of the eloquent rustic is as great a fallacy as the companion theory of the noble savage.

Wordsworth has suffered much from injudicious admirers, from those who would make it a pious article of belief that everything he wrote is good. Between his best work and his worst there is a great gulf fixed, wider than that which separates the best and the worst work of any other equally great poet. He "utter'd nothing base" in the moral sense of the word; but from the point of view of art there is much base metal in his writings, nor did he himself possess any touchstone which enabled him to distinguish this base metal from gold.

He passed through the needle's eye of Matthew Arnold's approval only after dropping much of his poetical baggage. His best poems are beyond all praise; to discuss his worst "were to waste criticism upon unresisting imbecility, upon faults too evident for detection, and too gross for aggravation."

Lamb said of him that his standard of intoxication was miserably low; his standard of inspiration was even lower.

All his best work was written be-

tween 1798 and 1808. It is to be noted that he always wrote better when he was out of his rut; travel or excitement acted on him like wine.

On the strength of his best work he stands among the greatest of English poets, and takes a place near Virgil as a lover and interpreter of nature.

George Borrow in *The Romany Rye* (chap. xxii.) ironically praised the soporific qualities of Wordsworth's pedlars and rustics, whose talk, mostly on subjects moral or metaphysical, was "couched in the most gentlemanly and unexceptionable language, without the slightest mixture of vulgarity, coarseness, or pie-bald grammar."

He wrote truer than he knew. Wordsworth's best poems are an anodyne for those who find the world too much with them; like sleep, they "knit up the ravell'd sleave of care," and are "balm of hurt minds, great nature's second course."—BIBLIOGRAPHY: Matthew Arnold, *Essays in Criticism* (second series); S. T. Coleridge, *Biographia Literaria*; C. H. Herford, *The Age of Wordsworth*; E. Legouis, *The Early Life of Wordsworth*; W. Knight, *Wordsworth's Poetical Works* (with a life in 3 vols.); Sir W. Raleigh, *Wordsworth*; H. Crabb Robinson, *Diary*; Christopher Wordsworth, *Memoirs of W. Wordsworth*.

WORK. In physics, defined as the product of a force by the distance which its point of application moves in the direction of the force. If the point of application of a force F moves along a straight line of length s, and if the direction of the force makes an angle θ with the straight line, then the work done, according to this definition, is $Fs\cos\theta$. The chief British units of work are the foot-pound (q.v.) and the foot-poundal.

In the C.G.S. system (a system of units based on the centimetre, gram, and second) the unit of work is the *erg*, which is the work done when the point of application of a force of 1 dyne moves through 1 cm. A joule is ten million, or 10^7, ergs. The unit of power called the *watt* (q.v.) is equivalent to 1 joule per second. *See* DYNAMICS; ENERGY, PHYSICAL.

WORKINGTON. A borough and seaport of Cumberland, England, at the mouth of the Derwent. Its industrial establishments comprise large iron-smelting works and works for steel rails, iron plates, shipbuilding, etc., while there is a considerable shipping trade. Pop. (1931), 24,691.

WORKMEN'S COMPENSATION. *See* EMPLOYER'S LIABILITY ACT.

WORKS, OFFICE OF. English Government Department. It is under the control of a First Commissioner, all the secretaries of state, and the President of the Board of Trade. Its main duty is the maintenance of the royal palaces and governmental buildings, and parks open to the public. It also has control and care of ancient monuments.

WORKSOP. A market town of Nottinghamshire, England, 27 miles north of Nottingham. It has a beautiful Norman church. Worksop is an agricultural centre with a cattle market, and has also sawmills and chemical-works. Pop. (1931), 26,286.

WORLD ECONOMIC CONFERENCE. The World Monetary and Economic Conference was opened by the King on 12th June, 1933, after just a year of preparation.

The idea of a conference had been "in the air" for some time. But the definite decision to summon it was taken by the League of Nations Council in July, 1932, at the suggestion of the powers represented at the Lausanne Conference on Reparations.

The preparatory work was largely in the hands of two expert commissioners who drew up an annotated draft agenda as the basis of the Conference work.

It surveyed the problems to be considered by the Conference and made suggestions for dealing with them. It stressed the need for rapid action.

"We believe," it said, "that partial remedies . . . would not be successful. What is needed is a comprehensive programme of world reconstruction, and this should be carried through as rapidly as possible."

The same note of urgency and optimism was struck at the opening sitting in the Geographical Museum.

The King declared that the "august assembly" represented "the hopes and the views of the entire world."

"We give to the world as the note of our first meeting," said Mr. MacDonald, "that we are determined to succeed . . . Rapidity of action is essential to success. Let the world know that we can show decision and give leadership."

But, in spite of these big words, the Conference ran quickly into deadlock, and produced neither leadership nor decision. Most of the problems on its agenda it evaded or postponed, and when it adjourned on 27th July for an indefinite recess, it had achieved nothing.

Three days general debate gave warning of the trouble ahead. The French made it clear that they would insist on immediate stabilisation of

the dollar and pound on a gold basis, and that, unless and until this were done, they regarded it as waste of time to discuss anything else. Nor did the discussions on tariffs, quotas, and other trade restrictions give evidence of any real intention on the part of governments to practise themselves the reductions they were ready to preach to others.

Trouble began immediately the general debate was ended and the Commissions set up.

On the economic side, Mr. Hull, the U.S. Secretary of State, produced a resolution in favour of an all round reduction of tariffs which was immediately repudiated by his government, while Mr. Runciman declared against any general agreement on tariff reduction, and announced that the British government preferred to make separate bargains with each foreign country.

These two incidents rather took the heart out of the Economic Commission. But meanwhile the Monetary Commission and its sub-committees had been brought to a complete standstill by a sharp quarrel between the "gold block" (France, Italy, Belgium, Holland, and Switzerland).

The gold block countries, alarmed by the possibility of being themselves driven off gold, tried to persuade the British and American governments to commit themselves definitely to immediate stabilisation, to strict control of exchange speculation, and to support of their efforts to remain on gold.

For two weeks the work of the Conference was virtually suspended while these negotiations went on. There were inspired rumours that unless the French and their allies got the assurance they wanted they would leave the Conference.

At last on 30th June, the British and the "gold block" agreed on a "formula." It was a carefully guarded declaration which commended the efforts of the gold countries to keep the gold standard, and promised rather vaguely to do something about speculation.

Mr. Chamberlain would go no further. The gold countries decided to accept it as the best for which they could hope. But the British acceptance of the formula was conditional on American acceptance.

It was, perhaps, too lightly assumed that Mr. Roosevelt would be ready to associate himself with a declaration which Professor Moley (believed to be his closest adviser in such matters) declared to be acceptable.

The shock was therefore the greater when on 3rd July came a message from the President rejecting not only the precise form of the declaration, but the whole idea on which it was based.

He announced definitely that the United States would manage its currency, not so as to keep the foreign exchanges stable, but so as first to raise and then to stabilise its own internal prices.

The gold block countries at once demanded the immediate adjournment of the Conference, declaring that it was useless to go on. For a few hours it looked as though this view would prevail.

On the morning of 4th July, the small "steering committee" decided to recommend adjournment to the Bureau. The Conference seemed dead.

But in the afternoon, Mr. Hull asked that so momentous a decision should not be taken without time for consideration. He secured a thirty-six hours' postponement of any decision.

During these thirty-six hours there was a rally of the states which were for going on. Mr. Bennett, the Canadian Premier played a big part in this. The British delegation threw its weight against adjournment.

The French and the rest of the gold block retreated. They abandoned their demand for adjournment, but proposed instead that all controversial questions be struck off the agenda.

The Bureau, at Mr. MacDonald's suggestion, passed a resolution that the Conference work should go on "as rapidly as possible"; but at the same time asked every sub-commission to report what portion of its work could usefully be continued.

After two days' bickering in the sub-commissions, all but one of them reported a division of opinion, but took no votes. The exception was the First Monetary Sub-Commission, in which a vote was taken. There were 25 states for proceeding with the whole agenda, 15 against: but the 15 included nearly all Europe, except the Scandinavian countries.

The crisis lingered over the week-end. Then a compromise was found. The agenda remained untouched. But each sub-commission and sub-committee was instructed to take first the subjects to which no one had any objection. And the Conference was to adjourn for a "recess" in the last week of July.

On 12th July, after wasting a month on this barren controversy, the Conference really began work: with just a fortnight before it.

It was by now completely demoralised. Sub-committees and sub-commissions began with one accord to seek ways of avoiding decisions and even discussions.

It was characteristic that in its only public session after resuming work the Economic Commission shelved two important proposals that had been before it since the earliest days of the Conference.

The proposal for international co-operation in public works was killed by Mr. Runciman's announcement that the British delegation would refuse even to discuss it in Committee.

The Soviet suggestion of a pact of economic non-aggression was referred to a Drafting Committee, which never attempted to consider it.

The Monetary Sub-Committees produced reports which were a mixture of pious generalisations and records of failure to agree.

The Economic Sub-Commissions were similarly barren.

Out of all the discussions the only definite result was an agreement between the silver-producing and silver-currency countries to restrict sales and so keep up the price of silver.

And so the Conference, having successfully come through its crisis, faded away in an atmosphere of demoralisation and defeatism.

The Americans tried at the end to have a date fixed for the meeting of the Bureau. But they were alone. And it was finally decided to adjourn *sine die*, in the hope that before long world conditions might have changed sufficiently to allow of a resumption.

The closing session on 27th July did indeed leave some hope that the Conference would meet again; but it was not a strong one.

It was, however, followed by a meeting of the United Kingdom, Dominions, and Indian Delegations, at which a joint statement was approved which indicated the formation of an Imperial Currency Alliance to which other countries of the vaguely existing "sterling group" would be invited to adhere.

That and the success of M. Litvinov in negotiating during the Conference a series of political non-aggression pacts with all the Soviet Border States and the members of the Little Entente, are the only tangible results of the first session of the World Conference.

WORMS (ancient **Borbetomagus**). A city of Germany, in the Rhein-hessen division of the German Republic of Hesse, on the Rhine; served by the Mainz-Weissenburg, Worms-Darmstadt, and other lines. The chief buildings of interest are the Romanesque cathedral (consecrated 1181); the Liebfrauenkirche and church of St. Martin; the town-house; and the monument to Luther, consisting of a colossal statue on a raised platform surrounded by figures of precursors of or persons directly connected with the Reformation. At Worms was held the famous Diet in 1521, at which Luther defended his doctrines before the Emperor Charles. Pop. (1925), 47,015.

WORMWOOD. The common name of several plants of the genus Artemisia. Common wormwood (*A. Absinthium*), a well-known plant, is celebrated for its intensely bitter tonic and stimulating qualities, which have caused it to be an ingredient in various medicinal preparations, and even in the preparation of liqueurs. It is also useful in destroying worms in children.

WÖRTH. The German name of the French *Woerth-sur-Sauer*, a town of France, department of Bas-Rhin, on the Sauer; served by the Lembach-Walburg (for Wissembourg) Railway. At Wörth, during the Franco-German War, MacMahon was defeated by the Crown Prince of Prussia (6th Aug., 1870). *Reichshofen* is the French name for the battle. Pop. 2000.

WORTHING. A borough and watering-place of Sussex, England. It is a fashionable resort, having an esplanade, libraries, reading-rooms, etc. A new town hall is in the course of erection. In 1929 the area of the borough was extended by the inclusion of Goring and other outlying areas. Pop. (1931), 46,230.

WOTTON, Sir Henry. English diplomatist and poet, born 1568, died 1639. He was educated at Winchester and Oxford, resided on the Continent for some years, and on returning to England was employed as secretary to Essex.

On the fall of that nobleman from power (1600) Wotton fled to Florence, where he was employed by the grand-duke to reveal to King James of Scotland a plot against his life. When the Scottish king ascended the throne of England, he showed his gratitude by making Wotton a knight, employing him abroad as an ambassador, and ultimately (1624) appointing him provost of Eton. His ability as a writer is shown in *Reliquiæ Wottonianæ*, published in 1651, with Izaak Walton's *Life of Wotton*.

WRANGELL, Ferdinand, Baron. Russian explorer, born 1794, of Swedish descent, died 1870. He commanded an exploration party (1820-4) on the north-east Siberian coast, and was Governor of Alaska between 1831 and 1836.

WRANGELL, or WRANGEL ISLAND. An island of the Arctic Ocean, in 71° N. lat., 179° W. long., 80 miles long by 30 miles wide, and about 100 miles from the north Siberian

coast. Discovered by Captain Kellett (British) in 1849, the Union Jack was hoisted there by Stefansson in 1914, and again in 1914 by Maurer. In Sept., 1921, the Crawford Expedition, financed by Stefansson, arrived there, but a relief ship failed to reach them (1922), and the Noice Expedition (1923) found only an Eskimo woman, the rest having perished.

Soviet Russia, during 1923, laid claim to the island as part of the discoveries (1821) of the Russian explorer Wrangell, and the Soviet flag was hoisted there in 1924. Britain decided not to contest the claim. The island was settled by Soviet Russia in 1926.

WRANGELL ISLAND. An island of Alaska, containing Wrangell, a former fort founded in 1833, and now inhabited mainly by Thlinkit Indians. It is noted for local deposits of almandine.

WRANGELL MOUNTAIN. An active volcano of Alaska; altitude, 17,400 feet (Blackburn Peak).

WRANGLER. In Cambridge University, the name given to those placed in the first class in the public examination for honours in mathematics, commonly called the *Mathematical Tripos*. The terms senior, second, etc., wrangler and the system of placing candidates in strict order of merit disappeared after 1909, and the names in each class are now arranged in alphabetical order. The old names of wranglers, senior optimes, and junior optimes are still used, however, for first, second, and third class in part ii. of the Mathematical Tripos.

WRASSE (ras). The name of various species of fish belonging to the family of Labridæ. They are prickly spined, hard-boned fishes, with large double and fleshy lips. Several species are natives of the British seas, as the ballan wrasse, or old wife (*Labrus tinca* or *maculatus*), which attains a length of about 18 inches.

WRECKING, or the luring of ships to their destruction for purposes of plunder, was formerly widely practised on the Cornish coast. Whole families are said to have depended for their livelihood on this nefarious trade.

WREN, Sir Christopher. English architect, born at East Knoyle, Wilts, in 1631; died in London 1723. He was educated at Wadham College, Oxford; became a Fellow of All Souls in 1653; was appointed professor of astronomy at Gresham College in 1657, and three years later was elected Savilian professor of astronomy at Oxford.

He had been appointed by Charles II. to restore old St. Paul's, but after the great fire (1666) it became necessary to rebuild the cathedral. In preparing his plans he was considerably hampered by the ecclesiastical authorities, who insisted on a chancel, while Wren wished the church to be in the form of a basilica; but with the king's permission he modified and improved the design as the building proceeded.

The cathedral was begun in 1675, and the architect saw the last stone laid by his son thirty-five years afterwards. Among other notable buildings which Wren designed are: the modern part of the palace at Hampton Court; the library of Trinity College, Cambridge; the hospitals of Chelsea and Greenwich; and the churches of St. Stephen's, Walbrook, and St. Mary-le-bow. In 1680 he was chosen president of the Royal Society. Over the north doorway of St. Paul's is a memorial tablet on which are the well-known words: *Si monumentum requiris, circumspice.*

WREN. A name given to certain perching birds of the family Troglodytidæ, distinguished by their small size, slender beak, short, rounded wings, mottled plumage, and the habit of holding the tail erect. The wren proper (*Troglodytes parvulus*) is, with the exception of the golden-crested wren, the smallest bird in

Wren

Europe, averaging about 4 inches in length.

The organ-bird or house-wren (*T. domesticus*) of the Amazonian region is a familiar summer visitant of North America east of the Rocky Mountains. The name "wren" is also popularly applied to various other small birds, such as the golden-crested wren (*Regulus cristatus*) and the willow-wren (*Phylloscopus trochi-*

lus), both of which belong to the warbler division of the thrush family.

WREXHAM. A municipal borough of Denbighshire, North Wales, on the Clywedog. Its church of St. Giles, built about 1470, is one of the finest old Gothic buildings in North Wales. The town has large breweries, tanneries, paper-mills, etc. Pop. (1931), 18,567.

WRITING. *See* ALPHABET; CUNEIFORM WRITING; HIEROGLYPHICS; ILLUMINATION; MANUSCRIPTS; OGHAM; RUNES; SHORTHAND.

WRYNECK. A bird allied to and resembling the woodpeckers. One species, the common wryneck (*Iynx torquilla*), is a summer visitant of England and the north of Europe. It is remarkable for its long tongue, its power of protruding and retracting it, and the writhing snake-like motion which it can impart to its neck without moving the rest of the body. It feeds chiefly on insects.

WUHAN. The name given to the three towns at Hankow (q.v.).

WULFENITE. A mineral lead molybdate, colour yellow or orange, source of molybdenum.

WÜRTTEMBERG (*Volksstaat Württemberg*). A Republic of Southern Germany; area, 7530 sq. miles; pop. (1925), 2,580,235. Except a few tracts in the south, the surface is hilly and even mountainous. In the west the Schwarzwald, or Black Forest, forms part of the boundary, and the Alb or Rauhe Alp, forming part of the Franconian Jura, covers an extensive tract. The country belongs mainly to the basin of the Rhine, being drained northward into that river by the Neckar, while the Danube flows across the southern districts. A part of the Lake of Constance is also included in Württemberg.

Climate, Production, etc. The climate is temperate, the mean annual temperature in the mountains being about 40° F., and in the Neckar Valley about 45° F. In the lower and more favourable districts the fig and melon ripen in the open air, and the vine, cultivated on an extensive scale, produces several first-class wines; maize, wheat, hops, tobacco, and fruit, which is employed in cider-making, are largely cultivated. About a third of the country is under forests, which consist chiefly of oaks, beeches, and pine. Of minerals, by far the most valuable are iron and salt, both of which are worked by the Government. Manufactures consist chiefly of cotton, woollen, and linen goods, paper, wooden clocks, toys, musical instruments, and chemical products.

Communications A trunk line of railways ex Munich, and via Ulm, Stuttgart, Ludwigsburg, and Mühlacker, traverses the republic, and runs to Bruchsal (in Baden).

Constitution. There is a State President, who is President of the State Ministry, a body appointed by the Landtag (101 members, elected for four years), which holds supreme power within the republic.

Religion and Education. In monarchic days, the king was invested by the Constitution with the supreme direction and guardianship of the Evangelical Protestant Church. This duty is now performed by a president and councillors, who are represented by commissioners at Ulm, Heilbronn, Ludwigsburg, and Reutlingen. In 1925 there were 1,753,654 Protestants, 796,870 Roman Catholics, 2242 other Christians, and 10,827 Jews.

Education is generally diffused, and the centre of the educational system is the University of Tübingen.

Towns. Besides Stuttgart (the capital), the chief towns are: Ulm, Heilbronn, Esslingen, Reutlingen, Ludwigsburg, Göppingen, Tübingen, Gmünd, Heidenheim, Ravensburg, Tuttlingen, Zuffenhausen, and Aalen. Other towns are: Schwenningen (pop. 18,978), Feuerbach (21,055), Geislingen (13,762), Ebingen (12,128), Schwäbisch-Hall (q.v.), Cannstadt (q.v.), and Plochlingen.

History. Previous to the Napoleonic era the rulers had the title of duke, but in 1806, by the favour of Napoleon, the reigning duke gained a great accession of territory, as well as the title of king. In the subsequent arrangement of the European states by the Congress of Vienna the territorial accessions were confirmed and the kingly title formally recognised. In the war of 1866 Württemberg sided with Austria against Prussia, but became a member of the German Empire on its foundation in 1871, and the royal house fell in Nov., 1918, when the republic was proclaimed.

WÜRZBURG (Rom. *Wircebirgum*). A city in the Republic of Bavaria, on the Main. It is dominated by the fortress of Marienberg. The most important edifices are the Romanesque cathedral, erected in 1042 in place of a foundation of 862; the university; the Julius hospital and school of medicine; and the palace (1720-44). The university library has 200,000 volumes. Its manufactures include scientific instruments, pianos, and tobacco. Pop. (1925), 95,113.

Würzburg was a concentration place

for troops of the German Empire, and its railway communications are extensive. The main line is the Frankfurt - Aschaffenberg - Gemünden (for Schweinfurt)-Würzburg system, which bifurcates at Würzburg for Treuchtlingen, via Kitzingen and Nürnberg (the route followed by the Vienna-Ostend express), or via Ansbach and Gunzenhausen. Direct services are maintained to Regensburg (for Passau), via Nürnberg, to Bamberg, via Schweinfurt, and to Heidelberg.

WURZEN. A town of Saxony, on the Mulde; the junction for Glauchau, on the Leipzig-Dresden railway. Iron-founding, bleaching, weaving, paper-, piano- and leather-making are the chief industries. Pop. 20,000.

WY'ANDOTS (in Canada called *Hurons*). An Indian tribe in North America belonging to the Iroquois family. In the beginning of the seventeenth century they were settled on the eastern shore of Lake Huron, but in a tribal war (1636) they were nearly exterminated by the Iroquois.

A breed of domestic fowl is called the **Wyandotte.** It was first bred in America. In colour the breeds are white and black, and the hens are good for both laying and sitting.

WYATT, Sir Thomas. English poet and diplomatist, the first writer of sonnets in the English language, born 1503, died 1542. His poetical works, which include elegies, odes, and a metrical translation of the Psalms, were published in 1557, along with those of his friend the Earl of Surrey.

WYCHERLEY, William. English dramatist, born about 1640, died 1716. He was educated in France, in order to avoid the Puritan influences which dominated English education during his youth, and at Queen's College, Oxford, where he did not matriculate, much less graduate. He was admitted a member of the Inner Temple in 1659, but only acquired sufficient law to enable him afterwards to depict the litigious Widow Blackacre in *The Plain Dealer*.

There is some doubt as to when he wrote his four comedies. He told Pope " over and over " that he wrote *Love in a Wood* when he was but nineteen, *The Gentleman Dancing-Master* at twenty-one, *The Plain Dealer* at twenty-five, and *The Country Wife* at one or two and thirty. It is almost certain that he antedated the composition of all these plays in order to boast of his own precocity. The dates of the production of the comedies appear to have been: *Love in a Wood*, 1671 (published the same year); *The Gentleman Dancing-Master*, 1671 (published 1673); *The Country Wife*, 1672 (published 1675); and *The Plain Dealer*, 1674 (published 1677).

Wycherley's first comedy secured for him an intimacy with the notorious Duchess of Cleveland, an intimacy which did not prevent the king from being on friendly terms with him. He would have been appointed tutor to Charles's natural son, the Duke of Richmond, had he not with great imprudence married the Countess of Drogheda, who, after making him thoroughly unhappy, died and bequeathed to her husband a lawsuit instead of a fortune.

Wycherley's old age was not a happy one. His health was poor, his memory weak, and he was constantly in debt. When he was sixty-four he struck up a friendship with Pope, then a lad of sixteen. Pope was asked to correct some of Wycherley's poems, and did so with so much thoroughness that his friendship with the aged comedy-writer was more than once broken off.

Long afterwards Pope published his correspondence with Wycherley, after editing it so as to make his own conduct appear in a favourable light. Ten days before he died Wycherley married a young girl in order to spite the nephew who was his heir.

Wycherley's *Miscellany Poems* (1704) and *senilia* may be left entirely out of account when estimating his work. He owes his fame to his four comedies. *Love in a Wood* is, as is natural, the least mature of his plays, but it is a sufficiently lively and witty comedy. It is usually said to be modelled on Sir Charles Sedley's *The Mulberry Garden*, but the resemblance is slight, nor is it certain that Sedley's play is the earlier of the two.

The Gentleman Dancing-Master was a better, though a less successful play. It borrowed its central incident from Calderon's *El Maestro de Danzar*, a comedy of minor importance. *The Country Wife* is a splendid comedy, marred only by the obscenity which is in grain in it. Garrick, who produced an emasculated version of it known as *The Country Girl* (1766), merely made it insipid. It owes one or two incidents to Molière's *L'École des Femmes* and *L'École des Maris*.

The Plain Dealer, based on Molière's *Le Misanthrope*, is its author's masterpiece. It is excellent from its mocking dedication to its sarcastic epilogue, though inferior to Molière's masterpiece. As Voltaire said, " All Wycherley's strokes are stronger and bolder than those of

our *Misanthrope*, but then they are less delicate, and the rules of decorum are not so well observed in this play." Manly is a vigorously drawn character, and Fidelia,

> "Who went to sea for love of he
> In masculine array,"

though far below Viola in *Twelfth Night*, is not without a certain pathos.

Wycherley was second only to Congreve among the fine gentlemen who wrote comedies of repartee after the Restoration. He owes his lack of reputation to certain qualities which he shares with Juvenal. When he castigates vice he depicts it too realistically.—Cf. Charles Perromat, *William Wycherley : sa vie, son œuvre*.

WYCLIFFE, WICKLIFFE, WICLIFF, WYKLYF, etc., **John.** English reformer, born about 1320 at Hipswell, near Richmond, in Yorkshire, died 31st Dec., 1384. He was educated at Oxford ; was elected master of Balliol College, and in 1361 was appointed rector of Fylingham, or Fillingham, in Lincolnshire. He afterwards became doctor of theology and teacher of divinity in the university ; and for some time held the living of Ludgershall, in Buckinghamshire.

Disputes existed at this period between Edward III. and the Papal court relative to the homage and tribute exacted from King John, and the English Parliament had resolved to support the sovereign in his refusal to submit to the vassalage. Wycliffe came forward on behalf of the patriotic view and wrote several tracts, which procured him the patronage of John of Gaunt, Duke of Lancaster.

In 1374 he was one of the commissioners sent by the king to Bruges to confer with the nuncio of Gregory XI. respecting the statutes of provisors and præmunire. Shortly before Edward gave him the valuable rectory of Lutterworth, in Leicestershire, which he held till his death. Here he laboured zealously and unweariedly as a preacher and pastor, though he lived at times also in Oxford or London.

In some of his utterances he is said to have styled the Pope Antichrist, charging him with simony, covetousness, ambition, and tyranny. His opinions began to spread, and the Church grew alarmed. Courtenay, Bishop of London, summoned him to appear before a convocation at St. Paul's. Wycliffe appeared there on 19th Feb., 1377, attended by his friends, John of Gaunt (then the virtual ruler of England), Lord Percy, the earl-marshal, and others. Hot words passed between the bishop and the duke ; blows followed ; and the meeting broke up in confusion.

In May following the Pope addressed three Bulls to the king, the primate, and the University of Oxford, commanding them to take proceedings against Wycliffe, who in answer to the prelate's summons appeared in the chapel of Lambeth. Proceedings were, however, stopped by order of the queen-mother, and Wycliffe was dismissed with simply an injunction to refrain from preaching the obnoxious doctrines.

About this time he was engaged in translating the Bible from the *Vulgate* with the assistance of some of his friends. In 1381 he publicly challenged the doctrine of transubstantiation, and his heresies were condemned by the theologians of Oxford, as well as by a provincial council called by Archbishop Courtenay and held at the Blackfriars, London, in 1382. Wycliffe was proclaimed a heretic, his works were condemned to be burned, and some of his followers were imprisoned ; but he was allowed to retire unmolested to his rectory of Lutterworth.

About thirty years after his death his doctrines were condemned by the Council of Constance, and in 1428 his remains were dug up, burned, and the ashes cast into the Swift. The influence of his doctrines spread widely on the Continent, and may easily be traced in the history of the Reformation.

Wycliffe was the author of an enormous number of writings in Latin and English, and he ranks undoubtedly as the father of English prose. Many of his writings still remain in manuscript, and it was not until 1350 that the whole of his Bible appeared.—BIBLIOGRAPHY : Lewis Sergeant, *John Wyclif : Last of the Schoolmen and First of the English Reformers*; J. N. Figgis, *Typical English Churchmen* ; G. V. Lechler, *John Wycliffe and his English Precursors* ; T. Arnold (editor), *Select English Works of John Wyclif* ; J. C. Carrick, *Wycliffe and the Lollards* (World's Epoch-makers).

WYCOMBE, HIGH, or **CHEPPING.** A municipal borough of Buckinghamshire, England, on the Wye. Its chief industry is chair-making. Pop. (1931), 27,987.

WYE. A river of South Wales, which rises on Plynlimmon, in Montgomeryshire, passes through Radnorshire, Brecknockshire, and Herefordshire, and falls into the Severn near Chepstow (Monmouthshire) after a course of 130 miles.

WYKEHAM, William of. English prelate, statesman, and architect, born at Wykeham, Hampshire, in 1324, died 1404. Having taken holy orders, he was elevated to the rich see of Winchester, and in 1367 was appointed to the chancellorship of England. He founded (1387) the famous public school at Winchester, and a college at Oxford, now New College.

WYNBERG. A suburb of Cape-town, South Africa. It is on Table Mountain, and is famous for its vines.

WYNDHAM, Sir Charles. British actor, born 1837, died 1919. Educated for the medical profession, he early adopted the stage as a career, and made his first appearance in 1862. He became famous by his acting in *David Garrick*. He was a master of light comedy parts. From 1885 Miss Mary Moore, whom he married in 1916, was in association with him. He was knighted in 1902.

WYNTOUN, Andrew (*Androw*). Scottish chronicler, who lived in the early part of the fifteenth century. He was a canon regular of St. Andrews, as also prior of St. Serf's Inch, in Lochleven. His *Chronicle*, which is in the Scottish vernacular, and is called the *Oryginale Cronykil of Scotland*, begins with the creation of the world, and is brought down to the death of Robert III. in 1406.

It is ascribed to the reign of James I., and was completed about 1426. The first five books contain an outline of general history and geography, the four remaining books dealing with Scotland. The work was edited by David Laing for The Historians of Scotland Series (1872; second edition, 1906), and his edition (2 vols.) is founded on that of David Macpherson, published in 1795.

WYO'MING. One of the United States of America (admitted June, 1890). It is almost rectangular in shape, situated north of Utah and Colorado, west of Nebraska and South Dakota, and south of Montana; area, 97,914 sq. miles. The surface is to a large extent mountainous, the main chain of the Rocky Mountains extending from north-west to south-east.

The river system includes the Platte River with its tributaries in the south-east, the Green River in the south-west, and the Yellowstone, Big Horn, and Powder Rivers in the north. The mountainous districts abound in forests, and the soil of the valleys is a fertile loam very suitable for agriculture. Wheat, oats, and barley are the chief crops, and large tracts are used for stock-raising. The climate is arid, and the rainfall so precarious that irrigation has to be adopted on the arable lands.

The chief minerals are gold, silver, copper, tin, iron, petroleum, and coal, the last now extensively mined. Of the larger animals, grizzly and black bears and several species of deer are still abundant, but the buffalo, of which there used to be immense herds on the plains, are now nearly extinct. Indian reserves cover 3120 sq. miles.

Acquired by purchase from France, this territory was organised in 1868. In the north-west the Yellowstone district (3300 sq. miles) has been set apart as a great national park. The capital is Cheyenne City. Pop. (1930), 225,565.

X

X, the twenty-fourth letter of the English alphabet. Except when used at the beginning of a word, *x* in English is a double consonant, and has usually the sound of *ks*, as in *wax*, *lax*, *axis*, etc.; but when terminating a syllable, especially an initial syllable, if the syllable following it is open or accented, it often takes the sound of *gz*, as in *exhaust*, *exalt*, *exotic*, etc. At the beginning of a word it has precisely the sound of *z*.

XANTHUS. An ancient city of Asia Minor, the principal city of Lycia, on the River Xanthus. Its ruins were discovered in 1838 by Sir Charles Fellows, who removed many marble monuments, etc., and placed them in the British Museum during 1842 and 1843.

XAVIER, St Francis (zav'i-ėr; Spanish pron. *hȧv-i-er'*). Surnamed the *apostle of the Indies*. He was born in 1506 at the castle of Xavier in Navarre, and died in 1552. He fell under the personal influence of Ignatius Loyola, and became one of the first members of Loyola's Society of Jesus. Appointed Papal nuncio in the Indies (1542), he reached Goa, where, and in other parts of India, notably in Travancore, he prosecuted with success his missionary labours.

After proselytising in Ceylon, Malacca, and the Moluccas, he established a mission in Japan. In 1552 he started for China in the hope of converting it to Roman Catholic Christianity, but died when at no great distance from Canton. He was canonised in 1621.

XENIA. A city of Ohio, United States, the county seat of Greene county; served by the Hamilton & Dayton Railway. It is an agricultural centre, which, founded in 1797, became a city in 1870. Pop. 10,000.

XENOC'RATES, of Chalcedon. A Greek philosopher, disciple of Plato, born 396 B.C., and from 339 until his death (314 B.C.) head of the Academy at Athens. Metaphysics and ethics were his chief subjects, but of his numerous works only the titles are now known.

XENOPH'ANES, of Colophon. A Greek philosopher, born about 570 B.C.; for some time settled at Elea, and regarded as the founder of the Eleatic school of philosophy (q.v.). He died about 480 B.C.

XEN'OPHON. Greek historian, general writer, soldier and sportsman. He was born about 430 B.C., and died probably soon after 355 B.C. He belonged to an aristocratic family of the deme of Erchia. While still a boy he became an enthusiastic follower of Socrates, though his temperament afterwards led him to adopt an active rather than a contemplative life. He fought at Arginusæ (406 B.C.), and was present at the trial of the generals and the overthrow of the Thirty.

His political opinions rendered his continued residence at Athens unpleasant if not unsafe, and he was easily persuaded by his friend Proxenus to join, as a sort of free-lance, the army of Greek mercenaries led by the satrap Cyrus. This army was nominally taking the field against the Pisidians; actually it was going to attack Cyrus's brother, Artaxerxes Mnemon, the King of Persia. A battle was fought at Cunaxa (401), Cyrus was killed, and the principal Greek officers were treacherously murdered by the satrap Tissaphernes.

An army of ten thousand men was thus left without leaders in the heart of an enemy's country, and more than a thousand miles from home. Xenophon assumed supreme command of the army, and conducted what is one of the most famous retreats in all military history. After more than five months of marching, fighting, and meeting with adventures of all kinds they reached Trapezus; at last Xenophon handed his army over to the Spartan Harmost Thibron in March, 399. Near Pergamum Xenophon captured a wealthy Persian nobleman, whose ransom secured him a moderate competency for life.

The remainder of Xenophon's life was something of an anti-climax. He served under Agesilaus, King of Sparta, and was present (possibly as a non-combatant) at the battle of Coronea (394), when the Spartans defeated the Athenians and Thebans. For this he was banished by the

Athenians, and given an estate at Scillus in Elis by the Spartans. Here he devoted himself to a life of hunting, spending his spare time in educating his two sons and writing his various books. After the battle of Leuctra (371) Xenophon was driven from his estate. His sentence of banishment from Athens was cancelled, but he never resided there again. He ended his days at Corinth.

It is probable that all Xenophon's works are still extant; this fact alone bears witness to the high esteem in which he was held as an author. The most important and popular of his writings is the *Anabasis*, an account of the expedition of Cyrus and the return march of the ten thousand.

In the *Memoirs of Socrates* he gives a good account of his old master from the ordinary man's point of view. As a complementary picture to that given by Plato this book is invaluable. A small pamphlet *On the Apology of Socrates* is probably not genuine, and is certainly not important. The *Symposium* (Supper-party) is a brilliant Socratic dialogue which gives much valuable antiquarian information. The *Œconomicus* gives a pleasant picture of a Greek wife and household. The *Hiero* is a debate upon absolute monarchy between Hiero and Simonides. The *Agesilaus* is an example of that unnatural and insipid production the panegyric.

The first two books of the *Hellenica* are a continuation of Thucydides; books iii. to vii. give the history of the Spartan and Theban hegemonies down to the death of Epaminondas. The *Hellenica* is valuable as being the only contemporary account of events between 411 and 362 B.C., but it is obviously the work of an amateur in history.

Xenophon's other works include: *On the Constitution of Lacedæmon* (the companion-piece *On the Constitution of Athens*, a most interesting work, is not by Xenophon, but probably owes its preservation to the fact that it was attributed to him), *On Athenian Finance*, *A Manual for a Cavalry Commander*, *A Manual of Horsemanship*, *How to Hunt with Hounds*, and the *Cyropædia*, a political and philosophical romance.

BIBLIOGRAPHY: A. Croiset, *Xénophon, son caractère et son talent*; Sir Alexander Grant, *Xenophon* (Ancient Classics for Modern Readers Series).

XEROPHYTE. A plant adapted to scanty water-supply. Externally, the adaptation usually takes the form of reduction of leaf-surface, for instance in succulents, switch-plants, and plants with rolled leaves. The anatomical features also are usually such as to keep down loss of water by transpiration, e.g. stout epidermis, few and deeply sunk stomata, hairy or wax-coated shoots, etc. Storage of water is likewise often in evidence, especially among succulents.

Xerophytes are naturally most prevalent in dry districts, but also occur wherever local conditions tend to accelerate transpiration or to interfere with absorption of water by the roots; hence arctic and alpine species, epiphytes, and plants inhabiting the seashore or the sour soils of heaths, moorlands and peat-bogs are all more or less xerophytic.

XERXES I. King of Persia, famous for his unsuccessful attempt to conquer Greece, was the son of Darius and of Atossa, daughter of Cyrus. He began to reign 485 B.C., and continued his father's preparations for another Persian invasion of Greece. The army which he collected must on the soberest estimate have exceeded a million of men, with a fleet of 1200 sail. Xerxes crossed the Hellespont (480 B.C.), and met with no resistance until he reached the Pass of Thermopylæ.

After Leonidas had fallen there with his Spartans, Xerxes pressed forward and burned Athens, which had been forsaken by almost all its inhabitants. He watched from the mainland the naval battle of Salamis (Sept., 480 B.C.), and fled ignominiously after the overwhelming defeat of his fleet. Xerxes was assassinated 465 B.C.

XINGU. A river of Brazil, a right-bank tributary of the Amazon. It rises near lat. 15° S., long. 59° W., in the plateau of Matto Grosso, and after flowing north for 1300 miles joins the Amazon 240 miles west of Pará.

XIPHODON (zif'o-don). An Eocene genus of fossil mammals closely allied to Anoplotherium.

X-RAY SPECTRA. The more important facts relating to these are given in the articles RAYS, ELECTRIC; SPECTRA, THEORY OF; NUMBER, ATOMIC; MATTER. In the X-ray spectrometer, the instrument used by Sir W. H. and W. L. Bragg in their researches on the structure of crystals, the rays pass through slits in two lead screens, and strike very obliquely the face of an analysing crystal mounted on a goniometer.

The reflected rays enter an ionisation chamber connected to an electroscope, and the readings of the electroscope are plotted against the angles of incidence of the rays on the face

of the crystal. The crystal acts as a sort of diffraction grating in three dimensions.

If incident radiation of wavelength λ makes an angle θ with a face, which may be regarded as one of a set of parallel planes, in which the particles of the crystal can be arranged, then the radiation is partially reflected at each plane of the set. The different reflected waves will in general be out of phase with each other, in which case their resultant effect will be imperceptible. If, however, $2d \sin\theta = \lambda$ or 2λ or 3λ, etc., where d is the distance between two consecutive parallel planes, then it is easily seen from a figure that the reflected waves are in phase, so that the intensity of the reflected beam has a maximum value.

The graph therefore determines the ratio λ/d. If d is known for any one crystal, λ can thus be found for any homogeneous radiation, or d for any other crystal.

The value of the "lattice-constant" d for rock-salt has been calculated by Sir William Bragg to be $2{\cdot}81 \times 10^{-8}$ cm. More recently, methods have been devised which do not require the crystal to be of large size, and which can even be applied to crystalline material in the form of a fine powder.

XYLARIA. A genus of ascomycetous Fungi, group Pyrenomycetes. The black, antler-shaped fructifications of *X. polymorpha* are plentiful on rotting tree-stumps and logs.

XYLEM. The woody or water-conducting part of the vascular tissue of plants. Its most important constituents are tracheæ or wood-vessels and tracheids. *See* VASCULAR TISSUES.

Y

Y, the twenty-fifth letter of the English alphabet, was taken from the Latin, the Latin having borrowed it from the Greek Υ or upsilon. In modern English at the beginning of syllables and followed by a vowel it is a consonant; in the middle and at the end of words it is a vowel.

YABLONOI. *See* STANOVOI.

YACHT AND YACHTING. A yacht is a decked vessel, provided with either sails, steam, or internal-combustion engines as motive power, and used exclusively for pleasure-cruising or for the sport of yacht-racing. The term will thus include alike the two- or three-ton yawl or cutter and the floating palace of a prince or millionaire, capable of cruising in all weathers and in any sea. Our English monarchs had their yachts in very early days; but the name was first used in 1660, when Charles II. received the gift of a Dutch "jacht," the *Mary*. A hundred years before, Elizabeth had a yacht built for her at Cowes, now the southern headquarters of British yacht-racing, as the Clyde is the great Scottish centre of the sport.

Yachting has been popular in this country for two centuries, the Water Club of Cork dating from 1720, and a great impetus being given by the foundation of the Royal Yacht Squadron in 1812. Thirty years later the United States entered with enthusiasm into the amusement, and in 1851 the trans-Atlantic yacht *America* was successful at Cowes in securing the cup of the Royal Yacht Club. This the United States still holds, in spite of the efforts to recover it made by Sir Thomas Lipton with several successive *Shamrocks*.

The type of yacht employed for racing has been modified considerably since 1897. Under the tonnage rule, until that date, breadth of beam was heavily handicapped, while no measurement of sail area was taken. A large sail area, with a counterbalancing heavy keel, was consequently popular. The new rule took into consideration only length and sail measurement, and yachts at once became much broader, with but small displacement, and great overhang both fore and aft.

A later rule was introduced to tax any hollowness in profile. Yacht-cruising, apart from racing, as practised in and around almost every English harbour, is not only a healthy and delightful pastime, but a most valuable training-school for the navy and merchant service. — BIBLIOGRAPHY: A. H. Clark, *History of Yachting*; J. Denholm-Young, *Reed's Yacht Management*; Dixon Kemp, *Manual of Yacht and Boat Sailing*.

YACHT, ICE. A yacht rigged like a sailing vessel, with runners instead of keel, designed for sailing over ice.

YAK. The *Bos grunniens*, a fine large species of ox, with cylindrical horns, curving outward, long pendent silky hair fringing its sides, a bushy mane of fine hair, and long silky tail; inhabiting, both in the wild and the domesticated state, Tibet and the

Yak

higher plateaus of the Himálayas; called *grunniens* (grunting) from its very peculiar voice, which sounds much like the grunt of a pig. It is the ordinary domestic animal of the inhabitants of those regions, supplying milk, food, and raiment, as well as being used as a beast of burden and to draw the plough.

YAKIMA. A city of Washington, United States, the county seat of Yakima county; served by the Northern Pacific and other railways. It is an agricultural centre. Pop. (1930), 22,101.

YAKUTS. A nomadic people forming a division of the Siberian Turko branch of the Turanian family of peoples. About a quarter of a million in number, they occupy mainly the

valley of the Lower Lena, in North Eastern Siberia, and are engaged in horse- and cattle-raising. They are ostensibly Christians, but Shamanism prevails, although they are culturally among the most advanced of all the Siberian tribes. Their language is an archaic Turkish dialect. See map under TURANIAN.

YAKUTSK. An autonomous socialist soviet republic of the U.S.S.R., in Eastern Siberia, comprising almost the whole of the basin of the River Lena; area, 1,530,253 sq. miles; pop. (1931), 308,400. It was founded in 1922. From the afforested Vitim Plateau the country descends through a submontane region to the tundras and the Arctic Ocean. The Lena is the chief channel of communication, and the river-fisheries as well as those of the Kolyma Bay zone (herring, sturgeon, crucian carp, bass, sterlet, and burbot) are noteworthy.

Alluvial gold (around Olieminsk), furs, and salt are the chief products; many reindeer and sledge-dogs are bred. The Yakuts (q.v.) are the chief people. Yakutsk is the capital. It has air communication with Irkutsk, and around are iron deposits. Verkhoyansk (q.v.) is in the republic.

YALE UNIVERSITY. One of the oldest and largest of American universities, originally a collegiate school established at Saybrook, Connecticut, in 1701. It was removed in 1716 to New Haven, and soon after its name was changed to Yale College, after Elihu Yale (1649-1721), an early benefactor of the institution. The aggregate number of volumes in all the libraries of the university is over 1,000,000, of which 1000 were presented in 1730 by Bishop Berkeley. Its buildings are now very extensive, and its funds have greatly increased by private munificence. The teaching staff numbered (1931-2) 1351, and the total number of students was 5914.

YALTA. A seaport-town and watering-place of Crimea, on the Sea of Azov. The climate is temperate (mean annual, 62·5° F.; January, 38°; August, 86·4°). Pop. 22,953 (but much larger in season).

YALU RIVER. A river of Eastern Asia, rising in the Chang-pai-shan, and flowing south-west to West Chosen (Korea) Bay; length, 300 miles. It forms the boundary between the Chinese province of Feng-tien and Korea (Chosen). On 17th Dec., 1894, the Japanese defeated the Chinese fleet off the mouth of the Yalu, and in April, 1904, the Japanese gained a decisive victory over the Russians by forcing the passage of the Yalu.

YAM. A large esculent tuber or root produced by various plants of the genus Dioscorea, order Dioscoreaceæ, growing in the warmer regions of both hemispheres. Yams, when roasted or boiled, form a wholesome, palatable, and nutritious food, and are extensively cultivated in many tropical and sub-tropical countries. The Chinese or Japanese yam (*D. Batātas*) contains more nitrogenous and therefore nutritive matter, but less starch, than potatoes. It is hardy in Great Britain and thrives in the United States. The tubers of *D. alāta*, the West Indian yam, one of the species most widely diffused, sometimes attain a weight of 50 lb.

YANGTZE KIANG. One of the two great rivers of China. It is formed by two streams rising in Eastern Tibet, in 26° 30′ N. lat., 102° E. long., and after flowing east and then south enters the Chinese province of Yunnan. Pursuing a very tortuous course, much of it through most fertile and densely populated regions, it reaches the great city of Nanking, 200 miles from the sea, where it widens gradually into the vast estuary which connects it with the Yellow Sea.

Its whole course, under various names, is 3475 miles, and the area of its basin is computed to be 700,000 sq. miles. It is connected by the Grand Canal with Hwang Ho or Yellow River, and is navigable for vessels of considerable draught for 1800 miles from its mouth. By the Treaty of Tien-tsin the Lower Yangtze Kiang was opened to European trade; and 700 miles from its mouth is the treaty-port of Hankow, the great commercial port of Mid-China. The highest port on the river at present reached by steamers is Tchang, 1000 miles from its mouth.

YANNINA. *See* JANINA.

YAP. An island-group of the Caroline Islands, a German possession until 1914, now under Japanese mandate. Yap, the chief island, is volcanic and coral-fringed, and produces coco-nuts. Copra and pearl-shell are exported, but the island is mainly of importance as the nerve centre of submarine-telegraphic communications in the West Pacific, being the landing-place of cables to Madang (Papua), Menado (Celebes), Shanghai, and Manila (by way of Guam).

On this account the Japanese possession was disputed by the United States after the European War, and their differences were only settled by the Washington Conference and by the Yap Agreement (1921), which gave the U.S.A. full access to the

island. Area, 95 sq. miles; pop. 6735.

YARACUY. A state of Venezuela with a seaboard on the Golfo Triste. It is well-wooded, mainly flat, traversed by the Yaracuy River, and rich agriculturally, producing coffee, cacao, tobacco, sugar, and indigo. Towns are San Felipe (pop. 15,500; on a branch of the Tucacas-Barquisimeto railway), the capital, and Yaritagua (pop. 5000). State pop. 122,836.

YARE. A river of Norfolk, England. *See* NORFOLK.

YARKAND'. The chief town of the principal oasis of Chinese Turkistan, on the River Yarkand Darya. Pop. 89,000.—The river rises in the Karakorum Mountains, and helps to form the River Tarim, which traverses central East Turkistan, and enters Lop Nor after a course of about 1000 miles.

YARMOUTH, or **GREAT YARMOUTH.** A seaport, fishing-station, watering-place, and county borough of Norfolk, England. It is situated on a long and narrow tongue of land running from north to southward between the North Sea and the estuary of the Yare, and is connected by a bridge with Little Yarmouth, or South Town, in Suffolk. There are extensive sands and esplanades with two piers. Parallel with the north and south quays, extending for nearly a mile and a quarter, are the principal streets, crossed by numerous narrow lanes called "rows."

The parish church of St. Nicholas was founded in 1101. Yarmouth is the great seat of the English herring- and mackerel-fishery, and also furnishes white-fish. The curing of herring as "Yarmouth bloaters" is an important industry. During the European War, Yarmouth was bombarded by German battle-cruisers and torpedo-boat destroyers (3rd Nov., 1914; 25th April, 1916; and 14th Jan., 1918). Pop. (1931), 56,769.

YARMOUTH. A yachting centre of the Isle of Wight, England, on the Solent. A regatta is held in August. Pop. (1931), 893.

YARMOUTH. A seaport in Nova Scotia, the chief shipbuilding place in the province, and a noted summer-resort. Pop. (1931), 7055.

YARRA-YARRA. The Australian river on which Melbourne, Victoria, is situated. Its length is about 100 miles. On account of falls it is not navigable above Melbourne.

YARROW. A parish of Selkirkshire, Scotland. The River Yarrow, famous in song, issues from the foot of St. Mary's Loch, and flowing 14½ miles eastward falls into the Ettrick, 2 miles south-west of Selkirk. Pop. 459.

YEAR. The period of time during which the earth makes one complete revolution in its orbit. Its mean length is 365 days, 5 hours, 48 minutes, and 46 seconds. In popular usage, however, the year consists of 365 days, and every fourth year of 366.—*Anomalistic year.* See under ANOMALY.—*Civil year,* the ordinary year of 365 days.—*Ecclesiastical year,* from Advent to Advent.—*Gregorian year, Julian year. See* CALENDAR.—*Lunar year,* a period consisting of 12 lunar months.

The *lunar astronomical year* consists of 12 lunar synodical months, or 354 days, 8 hours, 48 minutes, 34 seconds. The *common lunar year* consists of 12 lunar civil months, or 354 days. The *embolismic* or *intercalary lunar year* consists of 13 lunar civil months, and contains 384 days. The Mahommedans and Jews use a lunar year.

YEAST. *See* FERMENTATION.

YEATS, William Butler. Irish poet and dramatist, born 1865. He has written poems, lyrical dramas, prose tales and sketches, and plays for the Irish theatre. His works include: *The Land of Heart's Desire* (1894); *The Secret Rose* (1897); *The Shadowy Waters* (1900); *Cathleen ni Hoolihan* (1902); *The Hour Glass* (1903); *The Cutting of an Agate,* a volume of essays (1919); *Reveries* (1916); and *Michael Robartes and the Dancer* (1921). Later works are: *Plays in Prose and Verse* (1923); *The Tower* (1928); and *The Cat and the Moon* (play, 1931). He was awarded the Nobel Prize for Literature in 1923, and has been Senator of the Irish Free State since 1922.

YEISK, or **IEISK.** A seaport of Kūban, Russia, on the Sea of Azov. It was laid out in 1848 on a sand-bank, and rapidly increased. It now has tanneries, tile-works, oil-mills, and soap-works. Pop. 29,529.

YKAT'ERINBURG, or **SVERDLOVSK.** A town, Russia, in the government and 170 miles S.E. of Perm, founded in 1723 by Peter the Great. It is the mining and metallurgy centre of the Ural regions; gem-cutting, the making of machinery, cloth, and candles are industries. Pop. 136,404.

YKAT'ERINODAR, or **YEKATERINO NIKOLSK.** A town of Russia in the Caucasus, chief town of the Kuban territory, on the River Kuban, a poorly-built place with a considerable trade. Pop. 161,172.

YKAT'ERINOSLAV, or **ONEPROPETROVSK.** A town of the Ukraine,

capital of a government of the same name, on the right bank of the Dnieper, 250 miles N.E. of Odessa. Founded in 1787, it is a manufacturing centre, producing iron, machinery, tobacco, and beer. Pop. 233,001.—The government, which is intersected by the Dnieper and reaches the Sea of Azov, has great mineral wealth, especially in coal (Donetz basin), iron, manganese, and rock-salt; and its fertile black-earth soil produces abundant crops of wheat and other grains. Area, 24,478 sq. miles; pop. 3,537,300.

YELETZ, or IELETZ. A town of Russia, government of Orel, at the confluence of the Ieletz and Lutchka. It has flourishing manufactures, and an extensive trade. Pop. 30,540.

YELL. The second largest of the Shetland Islands, separated from the Mainland by Yell Sound, and 25 miles north of Lerwick. It is about 17½ miles in length, and from half a mile to 6 miles in breadth. The surface is chiefly moorland, and fishing is the leading employment. Pop. (1931), 1883.

YELLOW. *See* COLOUR; PAINTS AND PIGMENTS; SPECTRUM.

YELLOW-BIRD. A small singing bird common in the United States, the *Carduelis tristis*, also known as the American siskin. In summer the male is of a lemon-yellow, with the wings, tail, and fore part of the head black.

YELLOW FEVER. A specific fever arising from the bite of an infected mosquito (q.v.). It is endemic in the West Indies, and on the coasts of Central and South America, and on the west coast of Africa, and is spread by shipping to other regions, where, however, it never takes a firm hold. The onset is sudden, with rigor, headache, and pains in the back and limbs, while a jaundiced appearance is noted early, and to this its name is due. These symptoms are followed in four or five days by vomiting; the vomit is black, due to the presence of blood, hæmorrhages from various parts of the body, scanty urine, and definite jaundice. The patient becomes very weak and prostrated, and death frequently occurs. The mortality varies from 30 to 80 per cent. The measures adopted against the mosquito Stegomyia are rapidly bringing the disease under control.

YELLOW-HAMMER. A small perching bird of the genus Emberiza, the *E. citrinella*; called also *yellow-bunting*. It belongs to the finch family. The head, cheeks, front of the neck, belly, and lower tail-coverts are of a bright-yellow; the upper surface is partly yellow, but chiefly brown, the feathers on the top of the back being blackish in the middle, and the t feathers are also blackish. T yellow-hammer is a resident in Britai and generally throughout Europe.

Yellow-Hammer

YELLOW SEA (Chin. *Hoang-hai*). An arm of the Pacific Ocean, on the north-east coast of China. It is very shallow, and its name refers to the lemon-yellow colour of its water near the land, caused by mud suspended in the water from the inflow of the Rivers Hoang-ho and Yang-tze-kiang.

YELLOWSTONE NATIONAL PARK. A region mainly in Wyoming, United States, which in 1872 was withdrawn from settlement by the United States Government to become a park or tract for the recreation of the people. Its area is 3350 sq. miles, besides a forest area of 2000 sq. miles reserved since 1891. Its surface is mainly an undulating plain, diversified, however, by mountain ranges, one of which, the Absaroka, a range separating the waters of the Yellowstone River from those of the Big Horn, contains some of the grandest scenery in the United States.

The whole region exhibits an endless variety of wild volcanic scenery —hot springs, mud volcanoes, geysers, cañons, waterfalls, etc. The geysers are more remarkable than those of Iceland, and are gathered together in the upper course of the Madison River, called at this point the Firehole. Yellowstone Lake, one of many, has an area of 150 sq. miles. A large part of the park is covered with forest. Stringent legislation protects the game, with the result that elk, deer, antelope, bear, and bison have taken refuge in it.

YELLOWSTONE RIVER. A river of the United States, which rises in the Rocky Mountains, about lat. 44° N. and long. 110° W. It passes through the lake of the same name, and runs northward through the

Yellowstone National Park, the eastern portion of which belongs to its drainage basin. Soon after issuing from the lake, the river makes at intervals a series of falls (Lower Fall being 308 feet high), and traverses cañons, one of which, the Grand Cañon, is 25 miles in length. The river ultimately joins the Missouri about lat. 48° N., after a course of some 1100 miles.

YELLOW-THROAT. A small North American singing bird (*richas marylandica*) of the warbler kind, and included in the thrush family.

YEMEN and **'ASIR.** Two imamates of Arabia occupying the southwest of the peninsula, and geographically forming a single unit. Yemen (area, 75,000 sq. miles; pop. *c.* 3,000,000) stretches between the coast and the desert north of the Aden Protectorate. The main exports are coffee and hides. The capital is San'a, and the chief ports are Hodeida and Mocha.

The Imam is of Zaidi sect and, after the Sultan of Nejd, is now the most powerful ruler in Arabia. 'Asir (area, 35,000 sq. miles; pop. *c.* 1,000,000) lies immediately north of Yemen and extends to the Hejaz frontier. The capital is Sabiya. The uplands were conquered by Ibn Sa'ud of Nejd in 1920, and his suzerainty was accepted in 1926. In 1930 an agreement was made with the Idrisi, or titular sovereign, by which it was annexed to the Hejaz, which had been conquered by Ibn Sa'ud in 1925. A dispute regarding the boundaries between 'Asir and Yemen was settled by a treaty in 1931.

YENISEI. A river of Asia, rising in Mongolia, and flowing northward through Siberia to the Arctic Ocean. Length, 3000 miles.

YENISEISK. A former province of Eastern Siberia, extending from the Chinese frontier to the Arctic Ocean.

YENISEISK. A town of Siberia, formerly the capital of Yeniseisk, on the Yenisei some 1520 miles from its mouth, and at the head of navigation for small sea-going steamers. The passage is open from June to November. The mean annual temperature is 28° F. Pop. 73,500.

YENI SHEHR. *See* LARISSA.

YEOMANRY. Volunteer cavalry regiments were first raised in the last decade of the eighteenth century. At this time there was a considerable danger of a French invasion, and the English Government was hard-pressed for troops. William Pitt was Prime Minister, and caused an Act to be passed authorising the compulsory raising of certain troops, among them being some regiments of "provisional cavalry." According to Fortescue, this was done in a half-hearted way for fear of causing discontent from the use of these compulsory powers, and shortly after the passing of the Act it was amended to allow of voluntary enlistment instead. The regiments so raised were known as Volunteer Cavalry or Yeomanry.

In 1804 an Act was passed amending all former Acts dealing with this force, and yeomanry were made liable in case of invasion to serve in any part of Great Britain. In 1907 yeomanry, in common with the other auxiliary troops, came under the operation of the Territorial and Reserve Forces Act of that year, and were merged in the Territorial Force.

At the beginning of 1922 the Army List showed fifty-five regiments of yeomanry as being in existence, but many of these have been converted into other arms, and some have been disbanded. Fourteen regiments of yeomanry remain, the senior being the Royal Wiltshire.

YEOVIL (yō'vil). A municipal borough of Somersetshire, England, on the River Yeo or Ivel. It is noted for its manufacture of gloves. Pop. (1931), 19,078.

YEW. An evergreen tree of the genus Taxus, nat. ord. Tacaceæ. The common yew is *T. baccāta*, indigenous in most parts of Europe, and found in many parts of Great Britain and Ireland. It is a handsome tree, growing to a height of from 30 to 40 feet, with numerous spreading branches, forming a dense head of foliage.

Its trunk is thick, and has been known to attain a circumference of 56 feet. Its fruit is a red berry with green seeds, which is poisonous to cattle and man. It used to be frequently planted in churchyards, and its tough elastic wood was extensively used in the manufacture of bows.

YEZD. A city of Persia, in an oasis in a sandy plain 190 miles south-east of Isfahan. It is noted for its velvet and other silk manufactures, and has a Zoroastrian community. Pop. about 30,000.

YEZO, or, officially, **HOKKAIDO.** The most northerly of the larger Japanese islands. It has an area of 30,114 sq. miles, or, with forty-four adjacent dependent islands, 34,276 sq. miles, forming 13·15 per cent of the total area of the Japanese Empire proper. The island is mountainous and volcanic, and is rich in minerals, including coal, gold, and silver. Towns include Sapporo, the capital (pop. 1930, 168,576), Hakodate (197,252),

and Otaru (144,887). Near Hakodate there are thermal springs.

YIDDISH (Ger. *Jüdisch*). The name applied to the Judeo-German dialect spoken in Russia, Poland, and America. Previous to the fourteenth century the Jews living in Germany spoke the dialects of the people among whom they dwelt. When, in consequence of the persecutions, they migrated eastwards, settling in Bohemia, Poland, and Lithuania, they took with them their mother-tongue.

Separated, however, from the mother-country, the vocabulary, instead of following the same development as the German language, was increased by a number of Hebrew and foreign words. For various reasons, mostly religious and political, the dialect continued to be spoken by the Jews in the East, and a very considerable Yiddish literature, both in prose and poetry, now exists.—Cf. L. Wiener, *The History of Yiddish Literature in the Nineteenth Century*.

YOGHURT. A nutritious and refreshing type of fermented milk, very popular in Bulgaria, and often called Bulgarian sour milk. It is produced from the milk of the goat, buffalo, or cow by the inoculation of pasteurised milk with a certain bacterium. Kumiss (Russian steppes), Kefir (Caucasus), and Leban (Egypt) are similar products, which contain acid and small amounts of alcohol. Kumiss is made from mare's milk, the others usually from cow's milk.

YOKOHA'MA. A city of Japan, the chief seaport of the empire, in the Island of Honshiu, and on the west coast of Tokyo Bay. It is a modern city (*see* KANAGAWA). Silk is the chief export, and metals, woollens, and cottons the chief imports. During the terrible earthquake of 1st Sept., 1923, the city was partly destroyed. Pop. (1925), 405,888. In 1927 nine surrounding towns and villages were incorporated in Yokohama; total pop. (1930), 620,306.

YOKOSUKA. A naval station on Toko Bay, Honshiu, Japan. Pop. (1930), 110,301.

YONKERS. A city of New York, United States, in Winchester county, a suburb of New York City, on Hudson River. It is largely residential, but has also manufactures. Pop. (1930), 134,646.

YONGE, Charlotte Mary. English author. She was born at Otterbourne, near Winchester, 11th Aug., 1823. *The Heir of Redclyffe* (1853) brought her not only fame but enough money to provide the schooner *Southern Cross* for Bishop Selwyn's Melanesian mission. *The Daisy Chain* (1856) yielded enough to build a missionary college in Auckland, N.Z. She published 120 books, and for 47 years edited *The Monthly Packet*. She died 24th March, 1901.

YONNE. A department of Central France, traversed by the River Yonne, which is navigable throughout it. The granite mountains in the south-east attain a height of 2000 feet. Large wheat and oat crops are raised, and the vines yield the finest red wines of Lower Burgundy, and the finest of white wines, the well-known Chablis. Horses are raised around Charny. Auxerre is the capital; Villeneuve (sur-Yonne), Joigny, Sens, Avallon, St. Florentin, and Tonnerre are other places. Area, 2892 sq. miles; pop. (1931), 275,755.

YORK. A cathedral city and archiepiscopal see of Yorkshire, England, the county town, on the Ouse where it is joined by the Foss. Said to have been founded in 983 B.C., York was a town of the Brigantes, but it first leaps into fame as *Eboracum* (*Eburacum*), the chief town of Roman Britain. After the Roman retirement, the place became a Danish borough as *Jordvik*, and to this period belongs the foundation of the archiepiscopal see (627) by Edwin of Northumbria, Paulinus being the first archbishop. The first charter dates from the reign of Henry II.

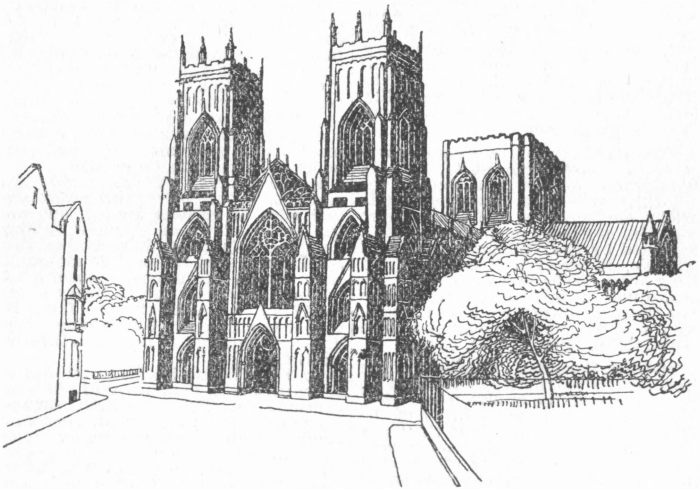
Dwarfing all other civic buildings in point of interest is the Minster, one of the most majestic of British cathedrals, which inherits a rich tradition dating back to the little wooden building of A.D. 627, out of which, and through edifices of the eighth, ninth, eleventh, twelfth, and thirteenth centuries, down to the reconstruction of 1472, the present magnificent pile has been evolved. The ruined Benedictine abbey of St. Mary's occupies the site of a Roman temple, and of a priory of St. Olave, founded 1078. St. Peter's grammar school (1557) and that of Archbishop Holgate (1546) are worthy of note. York is an important military centre and a great railway junction. The industries include railway works, cocoa factories, printing works, flour mills, etc. A model village has been built at Earswick, a suburb. Pop. (1931), 84,810.

YORK. A city of Pennsylvania, United States, the county seat of York county; served by the Maryland & Pennsylvania, and other railways. It is an agricultural centre with foundry products. Founded in 1741, it became a city in 1887. Pop. (1930), 55,254.

YORK. A city of Maine, United States, in York county, on the Atlantic; the terminus of a division of the Boston & Maine Railway. It is a prominent summer-resort. Pop. 9000.

YORK. A city of Nebraska, United States, the county seat of York county; served by the Chicago & North-Western Railway. It is an agricultural centre. Founded in 1864, it became a city in 1877. Pop. (1930), 5712.

YORKSHIRE. The largest county of England. The main portion of this



York Minster

county forms a large central valley stretching south-east to the Humber, flanked on one side by the Pennine range and on the other by the Cleveland Hills, and drained by the Ouse and its tributaries. The North Riding includes the Vale of York and the Cleveland district, with its iron ore.

	Acreage	Sq. Miles (approx.)	Population (1931)
County-city	3,730	6	84,813
West Riding	1,776,064	2,775	3,352,555
North Riding	1,362,058	2,128	468,389
East Riding	750,115	1,172	483,058
Total	3,891,967	6,081	4,388,815

Towns include York (the capital), Scarborough, and Middlesbrough. In the East Riding industrial activity is centred in Hull. In the North and West Riding there is much mountain pasture-land. The West Riding has long been famous for its woollen and worsted manufactures, of which it is now the chief seat. Their development has been aided by the proximity of coal and iron.

The great coal-field of the West Riding, part of that of Central England, yields not only excellent house coal, but also coal admirably fitted for iron-smelting and for use in engine furnaces. Leeds produces every variety of woollen goods; Bradford, mixed worsted fabrics and yarns; Dewsbury, Batley, and adjoining districts, shoddy; Huddersfield, plain goods, with fancy trouserings and coatings; and Halifax, worsted and carpets.

Barnsley is famous for its linen manufactures, of which Leeds also is a seat, as well as of that of leather. Next to the woollen and other textile industries comes the manufacture of iron and steel machinery, and implements of every description. Leeds is one of the principal seats of all kinds of mechanical engineering, and Sheffield of iron-work and cutlery.

YORKTOWN. A city of Virginia, United States, the county seat of York county, on York River; served by the Chesapeake and Ohio Railways. It is noted as the place where Cornwallis surrendered to Washington (19th Oct., 1781).

YOR'UBA. A country of West Africa, attached to the colony and

protectorate of Lagos. Area, 28,000 sq. miles; pop. 2,000,000. The Yorubas are a negro people, and have a tribal organisation. Among their large cities are Oyo, Ilorin (q.v.), Ibadan (q.v.), and Abbeokuta (q.v.).

YOSEMITE VALLEY. One of the greatest natural wonders of North America, in Mariposa county, California, about 140 miles south-east of San Francisco and midway between the eastern and western bases of the Sierra Nevada. It is a narrow valley at an elevation of 4000 feet above the sea, and is itself nearly level, about 6 miles in length, and varying in width from ½ mile to 1 mile. On each side rise enormous domes and almost vertical cliffs of granite, the Half Dome being 4737 feet higher than the River Merced at its base. The valley forms part of Yosemite National Park (1500 sq. miles).

YOUGHAL (yal). A seaport-town of Cork, Irish Free State, on the Blackwater estuary; a centre for monthly cattle fairs. Exports include bricks, earthenware, and corn. There is a salmon-fishery in the Blackwater. Founded by the Vikings in the ninth century, it received a charter from King John (1209), and was Cromwell's head-quarters in 1649. Myrtle Grove was the mansion of Sir Walter Raleigh, who was Mayor of Youghal in the year 1588-9. Pop. (1926), 5340.

YOUNG, Brigham. President of the Mormon Church; born 1801, died 1877. He was one of the twelve founders of Nauvoo, and after the murder of the prophet, Joseph Smith, and the flight of the Mormons from Nauvoo, Young became their leader. He was elected their president on their settling in Utah, and when this was made a territory he was appointed its Governor by President Polk. In 1852 he announced that polygamy had been commanded in a special revelation to Joseph Smith, and it was accepted generally by the Mormons of Utah.

Young was a man of great practical ability. Utah flourished under his rule, and he long withstood successfully the efforts of the United States Government to establish its authority there.

YOUNG, Edward. English poet, author of *Night Thoughts*; born in 1683, died in 1765. His father was rector of Upham, and subsequently Dean of Salisbury. Young was educated at Winchester College, of which his father was a Fellow, and at Oxford. He matriculated at New College, migrated to Corpus, and finally became a Fellow of All Souls. He graduated B.C.L. in 1714 and D.C.L. in 1719.

According to Sir Herbert Croft, "There are those who related that when first Young found himself independent . . . he was not the ornament to religion and morality which he afterwards became." According to Pope, Young passed "a foolish youth, the sport of peers and poets: but his having a very good heart enabled him to support the clerical character when he assumed it, first with decency, and afterwards with honour."

He was certainly a friend of Bubb Dodington and of the infamous Duke of Wharton; it is unlikely that their evil communications entirely failed to corrupt him. He excelled at writing fulsome dedications, and seems to have thought that flattery was the "Open Sesame" to worldly prosperity. He was doomed to be a disappointed man, and never attained the success as a layman or the preferment as a clergyman to which he believed himself to be entitled.

Poetic Works. Young began his career as a poet by writing addresses and odes of various kinds; one on the death of Queen Anne was, like Janus, two-faced, as it welcomed the coming and sped the parting monarch with equal enthusiasm. *Busiris*, a tragedy, was produced at Drury Lane in 1719; its chief title to fame is that it was ridiculed by Fielding. *The Revenge* appeared at the same theatre in 1721.

In 1725 Young began to publish a series of satires, *The Universal Passion*, collected in 1728. These satires brought £3000 to their author, and contain many quotable lines; but, as Swift said of them, "they should either have been more angry or more merry." *Ocean* and other odes appeared about 1728; some of these poems might well find a place in an anthology of humorous verse.

Young "assumed the clerical character" some time before 1728, when he became chaplain to George II. He married a daughter of the Earl of Lichfield in 1731; the death of his wife, in 1741, inspired him to write his masterpiece, *The Complaint, or Night Thoughts on Life, Death, and Immortality* (1742-4). This poem was immensely famous in its day, was translated into French, German, Italian, Spanish, Portuguese, Swedish, and Magyar, and even still is not without readers. It is a portentous monologue, containing much commonplace thought and many lines which have become proverbial. It was mainly on the strength of this poem that German criticism set Young above Milton. Young's other works include a third play, *The Brothers* (1753), and *Resignation* (1762). In 1761 he was made

clerk of the closet to the princess-dowager.

The great reputation of Young has almost entirely disappeared, but it is not inexplicable, like that of Tupper and other writers who have now fallen on evil days. As Johnson says, " with all his defects, he was a man of genius and a poet ;" and almost all his works contain oases of good writing amid a somewhat barren wilderness. He was not a good artist or a good self-critic. Many of his lines, however, have outlived his reputation, such as

> Procrastination is the thief of time ;
>
> A fool at forty is a fool indeed ;

and

> All men think all men mortal but themselves.

—BIBLIOGRAPHY : W. Thomas, *Le Poète Edward Young* ; George Eliot, *Essays and Leaves from a Notebook* ; Samuel Johnson, *Lives of the Poets*.

YOUNG, James. British chemist; born at Glasgow in 1811, died in 1883. He discovered a method of distilling oil from shale, and thus became the founder of the mineral-oil industry in Scotland.

YOUNG, Thomas. British scientist; born in 1773, died in 1829. He qualified himself for the medical profession, and made some useful contributions to medical science. In 1802 he became the colleague of Davy as professor of natural philosophy at the Royal Institution, having previously made the discovery of the interference of light, the result of researches which, completed by Fresnel, secured the triumph of the undulatory theory. In 1807 appeared his admirable *Lectures on Natural Philosophy*.

YOUNGSTOWN. A city of Ohio, United States, the county seat of Mahoning county, on Mahoning River; served by the Baltimore & Ohio, Erie, and other railroads. There are iron- and steel-works, blast-furnaces, etc. Founded in 1796, it became a city in 1867. Pop. (1930), 170,002.

YOUNG TURKS. A Turkish political movement of obscure origin, whose leaders planned the Revolution of 1908, restored to Turkey the Constitution granted in Dec., 1876, and " suspended " in Feb., 1878, deposed Sultan Abdul Hamid II. and set up his brother Reshad (Mahommed V.) in his place, and endeavoured by the modernisation of government methods and the doctrine of liberty, equality, and fraternity to justify Turkey's place as a European Power, and to stabilise her position by the creation of an efficient army and navy.

Among leaders of the movement were : Mahmud Shevkhet Pasha, Talaat Bey, Enver Bey, Ahmed Riza Bey, Niazi Bey, Dr. Nazim, Djemal Pasha, Djavid Bey, and Kiamil Pasha. Salonika was the original node of the movement, which was controlled by a "Committee of Union and Progress." *See* PAN-ISLAMISM ; PAN-TURANIANISM ; TURANIAN ; TURKEY.

YPRES (ē'pèr ; Flem. *Ypern* ; ī'pern). A town of Belgium, in the province of West Flanders, 21 miles north-west of Lille. From it the linen called *diaper* (d'Ypres) took its name. Its chief manufacture is lace. Ypres is especially associated with the British army and Imperial forces of the European War, in the course of which it was practically destroyed. Relics of the great Cloth Hall and the Cathedral St. Martin are preserved as memorials of the war, but the town itself has been repeopled and rebuilt. Pop. about, 15,000.

YPSILANTI. A Phanariot Greek family claiming to be descended from the Comneni.

Alexander, born 1725, died 1805, hospodar of Wallachia from 1774 to 1798, was executed at Constantinople.

Constantine, son of preceding, born 1760, died 1816, was hospodar of Wallachia and Moldavia from 1799 to 1805, when he was deposed and attempted the liberation of Greece. He was exiled, and died at Kiev.

Alexander, son of preceding, born 1792, died 1828, entered the Russian army (1809) and distinguished himself during the Napoleonic campaigns (1812-4). President of a Greek political club, he headed an insurrection in the Danubian principalities during 1821, was defeated by the Turks at Dragashan, and fled to Austria, where he died.

Demetrius, younger brother of preceding, born 1793, died 1832, joined the Greek forces in 1821 at the opening of the struggle for independence, and became Greek commander-in-chief in 1828. In 1829 his successful campaign was brought to a close by the capitulation of Aslan Bey.

YPSILANTI. A city of Michigan, United States, the county seat of Washtenaw county, on Huron River ; served by Michigan Central Railway. Founded in 1825 (the name honours Demetrius Ypsilanti), it became a city in 1858. Pop. (1930), 10,143.

YSER. A river of France and Belgium, rising in the department of Nord, and disemboguing into the North Sea below Nieuport (West Flanders) after a course of 55 miles. The battle of the Yser (European War) was fought between the 17th and 31st Oct., synchronously with

the first phase of the first battle of Ypres, and resulted in the complete hold-up of Albrecht, Duke of Württemberg's rush to Calais. *See* EUROPEAN WAR (last three paragraphs of section *First Battle of Ypres*).

YSSEL, or **IJSSEL.** In the Netherlands, a canalised arm of the Rhine, which leaves 2 miles above Arnhem, and flows across Gelderland and Overyssel to join the Zuider Zee below Kampen. At Doesburg it is joined by the Oude or Old Yssel, and the Arnhem-Doesburg section represents the Roman *Fossa Drusiana*, a canal built in 12 B.C. to connect the Old Yssel with the Rhine. The Netherlands Yssel is an arm of the Lek, traversing Utrecht and South Holland, and joining the Maas opposite Ysselmonde (pop. 8000).

YSTAD. A Baltic seaport of Sweden, län of Malmöhus; served by rail to St. Olof (via Gärsnös) and Malmö (39 miles), and by steamships to Copenhagen, Stockholm, Lübeck, Hamburg, Ronne, etc. There is an iron-foundry and ship-building, and manufactures include matches, sugar, chicory, and tobacco. Eggs, grain, molasses, oil-cake, etc., are exported. Pop. (1932), 11,425.

YTTRIA (Y_2O_3). The oxide of the rare element yttrium. Yttria is a white basic powder which readily absorbs carbon dioxide from the atmosphere. It occurs associated with other rare earth oxides in minerals such as *samarskite*, *gadolinite*, *monazite*, etc.

YTTRIUM (chemical symbol, Y; atomic weight, 89·33). One of the rare earth elements. It is related in some of its chemical properties to the metal aluminium. It forms an oxide of formula (Y_2O_3) and a chloride (YCl_3). The element is obtained by electrolysis of the fused chloride. It is greyish in colour, easily oxidised, and decomposes hot water.

YUAN SHIH-K'AI. First President of China, born 1859, died 1916. He became President in March, 1912, after making a tremendous effort to save the Manchu dynasty, and thereafter he applied his great qualities of statesmanship and organisation to the foundation of a new dynasty in his own person. When his schemes were complete—his enthronement had been arranged for Feb., 1916—the Japanese Government interfered, and he died shortly afterwards, retaining the presidency to the last.

YUCATAN'. A peninsula forming the south-eastern extremity of Mexico.

YUCATAN. The most easterly state of Mexico, in Yucatan Peninsula. Progreso and Sisal are ports; towns include Mérida (q.v.), Valladolid, and Motul. Among railways are those connecting Mérida with Peto and Progreso. Area, 15,939 sq. miles; pop. 350,000.

YUCCA. A genus of American plants, nat. ord. Liliaceæ. The species are handsome plants, with white odourless flowers.

YUGOSLAVIA. A south-east European kingdom, before 1929 known as the Serb, Croat, and Slovene State (*Kraljevina Srba, Hrvata, i Slovenaca*, abbreviated to S.H.S.). It stretches along the east coast of the Adriatic Sea, is bounded elsewhere by Italy, Austria, Hungary, Rumania, Bulgaria, Greece, and Albania, and consists of Serbia, Montenegro, Bosnia, Herzegovina, Croatia-Slovonia, Dalmatia, Slovenia (Carniola), and Voyvodina; area, 95,000 sq. miles; pop. (1931), 13,930,918.

The chief towns are Belgrade (the capital), Zagreb, Subotica, Sarajevo, Lyublyana, and Skoplye. For physical features, etc., see separate articles on constituent territories.

Production. Of the total area 55 per cent is cultivated, the chief products being maize, wheat, oats, tobacco, and fruits (plums, apples, olives, grapes). Stock-rearing is important, and 19,068,637 acres were afforested in 1931 (beech, oak, fir, etc.). There are considerable mineral resources, including coal, iron, copper, gold, lead, antimony, chrome, etc. Of manufacturing industries the principal are flour-milling, brewing, distilling, weaving, tanning, meat-packing, and carpet-weaving (at Pirot in Serbia).

Transport. There were in Yugoslavia, in 1931, 5728 miles of railway track (3624 miles being State-owned), and 1314 miles of navigable waterways (mainly Danube, Sava, Drava, and Tisa). Passenger air service between Belgrade and Zagreb was opened in 1928.

Religion, etc. By the Constitution religious freedom is assured; since 1931 the Church has been governed on an autonomous basis. The main religions are Serbian-Orthodox (48·75 per cent), Roman Catholic (37·46 per cent), and Mahommedan (11·12 per cent). Elementary education is compulsory and free, and secondary, commercial, etc., education are well provided for. There are universities at Belgrade, Zagreb, and Lyublyana, and a Law School at Subotica. Of the total population 9,000,000 speak Serbian and Croatian, and 1,000,000 Slovene. Military service is compulsory, and the army has a peace

strength of 191,189 all ranks. There is a small naval patrol force.

History. After the Austro-Hungarian revolution (1918) Slovenia, Croatia, Dalmatia, and Bosnia declared their independence, and there began a movement for the formation of a Serb, Croat, and Slovene State by the union of these areas with Serbia. In Dec., 1918, the first ministry of the new kingdom was formed, and received Allied recognition.

The boundaries with Italy were fixed by the Treaty of Rapallo (1920) and by the Italo-Yugoslav Treaty regarding Fiume (1924); the independence of the former Austro-Hungarian areas was formerly recognised by the Treaties of St. Germain (1919) and Trianon (1920); and the boundaries with Bulgaria were adjusted by the Treaty of Neuilly (1919). Montenegro did not join the union till 1921. In 1923 Yugoslavia obtained a free zone (9 sq. miles) in Salonica harbour.

The kingdom is governed by a king and a ministry responsible to a legislature of two houses, a senate and a chamber of deputies of 305 members elected by all adults.

By the Constitution (adopted 1921) the monarchy was made constitutional and hereditary in the Serbian House of Kara-Georgevitch. The first king of the new kingdom was Peter of Serbia, who was succeeded in 1921 by his son, Alexander I. In Jan., 1929, Alexander suspended the constitution and ruled for two years as dictator. In 1931 there was a return to constitutional government, but only in a modified form, and an election was held in November of that year.—BIBLIOGRAPHY: *Almanac of the Kingdom of the Serbs, Croats and Slovenes*; J. Buchan (Ed.), *Yugoslavia* (Nations of To-day); H. Baerlein, *The Birth of Yugoslavia*.

YUKON. A large river of North America, rising in Canada about lat. 57° 45′ N., long. 130° 45′ W.; pursues a generally westward course, of which the length is estimated at 2050 miles, the greater portion in Alaska, and enters the Pacific by several mouths. For great part of its course it is navigable by steamers. *See* ALASKA; CANADA; KLONDIKE.

YUKON. A north-western territory of Canada, intersected by the upper course of the navigable Yukon, and served by rail to White Horse (pop. 331) from the port of Skagway, in Alaska. The territory is of importance for gold on the Klondike and elsewhere, and also as a producer of coal, silver, and copper. Furs are produced, and there are fisheries and lumbering. Dawson (pop. 975), at the junction of the Klondike with the Yukon, is the capital. The area is 207,076 sq. miles; pop. 4157. Yukon is governed by a Commissioner and an elected Legislative Council of three members.

YUNNAN′. The most south-westerly province of China. It is rich in minerals, especially copper, lead, tin, and zinc. Yunnan-fu is the capital. Estimated area, 146,714 sq. miles; estimated pop. 11,020,591.

YURIEV, or **YURYEV.** *See* DORPAT.

YVERDON, or **YVERDUN** (ancient **Eburodunum**). A town of Vaud, Switzerland, at the south-western end of Lake Neuchâtel, on the Thièle; served by the Lausanne-Neuchâtel railway, with a light branch to Ste Croix (pop. 7000), a noted watch-making centre. A mile from Yverdon is the sulphur spring of Bains d'Yverdon. Pestalozzi's educational institution occupied the château (founded 1135) between 1805 and 1825, and a memorial stands before it (*see* PESTALOZZI). There are railway workshops, an iron-foundry, etc. Pop. 8627.

YVETOT. A town of France, in the department of Seine-Inférieure; on the railway Rouen-Havre. From the fifteenth to the middle of the sixteenth century the lords of Yvetot bore the title of *king*, and their lands were exempt from service to the French Crown; hence Béranger's song *Le Roi d'Yvetot*. Pop. 7126.

Z

Z, the last letter of the English alphabet, is a sibilant consonant, and is merely a vocal or sonant *S*, having precisely the same sound that *s* has in *wise*, *ease*, *please*, etc. (*See* S). The words in modern English which begin with *z* are all derived from other languages, mostly from the Greek. When not initial, however, we often find it representing an older *s* in genuine English words, as in *blaze*, *freeze*, *gaze*, *graze*, etc.

ZAANDAM, or **SAARDAM.** A town of the Netherlands, in the province of North Holland, on the Zaan; the junction for Enkhuizen on the Amsterdam-Helder railway. Pop. (1932), 33,772.

ZABRZE. *See* HINDENBURG.

ZACATE'CAS. A state of Mexico, belonging to the great central plateau, and averaging over 7000 feet altitude. It is more or less mountainous, and is specially noted for the mining of silver, which centres round Fresnillo (q.v.) and Sombrerete (pop. 12,000). Zacatecas (pop. 20,000), the state capital, served by the El-Paso-Mexico City railway, is also a silver-mining centre. Lead, zinc, iron, copper, gold, antimony, salt, etc., are also worked. Area, 24,471 sq. miles; pop. (1930), 465,021.

ZAFRA (ancient **Julia Restituta**). A town of Spain, in the province of Badajos; the junction for Huelva on the Merida-Sevilla railway. There are great cattle-markets, and oil and tanning industries. Pop. 10,000.—Another **Zafra** is in Cuenca province.

ZAGAZIG (Ar. *Al-Zaqâziq*). The capital of the Egyptian province of Sharkiyeh, at the junction of the railways from Cairo, Suez, Alexandria, and Damietta, and on the fresh-water canal, 6 miles from Tel-el-Kebir; a cotton centre, and the scene of Lord Wolseley's victory over Arabi Pasha, Sept., 1882. Pop. (1927), 52,839.

ZAGREB. The Yugoslav form of the Magyar *Zagrab* and Italian *Zagrabia*, the name of a town better known as Agram (q.v.).

ZAMBE'ZI, or **ZAMBESI.** The most important river in South-Eastern Africa, and the largest flowing into the Indian Ocean; it has its source in the Angola highlands, flows out of Angola into Northern Rhodesia, and from the Caprivi Corridor (*see* SOUTH-WEST AFRICA) separates Northern Rhodesia from Southern Rhodesia. Entering the Tete district of Portuguese East Africa, it forms the central drainage-basin of that region, and reaches the Indian Ocean by several mouths in the Mozambique Channel opposite Madagascar.

The delta of the Zambezi (over 2400 sq. miles in area) commences about 90 miles from the coast, a little below the entrance of the Shiré, the chief tributary, which forms the outlet of Lake Nyasa. The Chinde mouth is the only one useful for navigation, and is becoming more and more difficult (*see* PORTUGUESE EAST AFRICA and NYASALAND).

The length of the river is about 2200 miles, and it drains an area of 600,000 sq. miles. Navigation is interrupted by rapids and cataracts, among the latter being the Victoria Falls (q.v.). After passing through Rhodesia, in its middle course, the river enters Portuguese territory.

ZAMBEZIA. A general term usually applied to those British-Africa possessions traversed by or drained to the Zambezi, and extended sometimes to embrace the riverine central region of Portuguese East Africa. The Trans-Zambezia Railway links Nyasaland with the ocean at Beira, and avoids the necessity of picking a precarious passage up the Zambezi from Chinde. It branches off from the Beira-Mashonaland railway at Dondo, and cuts across country, through grand forests, and over the Zangue by a five-arch bridge to Murassa, on the river, 157 miles from Dondo and 175 miles from Beira. A ferry (2¼ miles) runs to Chindio, whence Blantyre may be reached by rail, 351 miles from Beira. The gauge is 3 feet 6 inches. The Zambezi bridged, the problem of entry to and exit from Nyasaland will be completely solved.

ZAMO'RA. A frontier province of North-Western Spain, a plateau (over 1000 feet altitude) broken in the north-west by spurs of the Cantabrians, and drained to the Douro

(which traverses the province from east to west) by the Esla (with the Tera), the Valderaduey, and the Tormes (forming part of the southern boundary). Grazing on the plateau and cereal-raising in the river valleys are the chief occupations. Towns include Zamora (the capital), Toro (q.v.), and Benavente (pop. 7000). Area, 4097 sq. miles; pop. (1931), 281,541.

ZAMORA. The capital of Zamora province, Spain, on the Douro; the junction for Medina del Campo on the Plasencia-Astorga railway. There is a trade in grain and wine. Pop. 21,557.

ZAMORA. A west-central state of Venezuela, comprising part of the eastern versant of the Cordillera de Merida, and a large area of the llanos. Stock-raising is the chief occupation. Towns include Barinas (pop. 5500); the capital, Guanare (pop. 11,000), a sugar and coffee centre; Nutrias; and San Fernando de Apure (pop. 10,000), a trading town and river-port at the Portuguesa-Apure confluence, shipping cotton, indigo, cattle, cacao, etc., downstream to Ciudad Bolivar. Area, 13,587 sq. miles; pop. 57,341.

ZAMORA. A town of Mexico, in the state of Michoacáan. Pop. 15,116.

ZANESVILLE. A city of Ohio, United States, the county seat of Muskingum county, on Licking and Muskingum rivers; served by the Pennsylvania and other railways. It is a pottery-manufacturing centre. Settled in 1800, it became a city in 1850. Pop. (1930), 36,440.

ZANGWILL, Israel. Jewish novelist and playwright, born in London in 1864. His stories, several of which treat of Jewish life, include *Children of the Ghetto, Dreamers of the Ghetto, The Mantle of Elijah,* and *Jinny the Carrier.* His plays include *The Melting Pot* and *The Forcing House.* He died in 1926.

ZAN'TE (ancient **Zakynthos**). A department of Greece, one of the Ionian Islands, 25 miles long and about 12 miles broad; area, 277 sq. miles. The greater part of the interior consists of a fertile and productive plain, almost covered with the dwarf grape which produces the so-called currants. Olives, almonds, oranges, and wine are also produced. The staple export is currants. Zante is the capital. Pop. (1928), 40,492.

ZANTE. A seaport of Greece, capital of the insular department of Zante. Carpets, gold and silver ware, silk goods, soap, etc., are made. Pop. (1928), 11,609.

ZANZIBAR'. A sultanate (British Protectorate) of East Africa, comprising the islands of Zanzibar (640 sq. miles) and Pemba (380 sq. miles), with a total population of (1931) 235,428 (137,741 in Zanzibar Island). Zanzibar town is the capital. The two islands are separated by channels, roughly 25 miles wide, from the mainland, the Pemba channel being open and safe, and the Zanzibar channel treacherous owing to its coralline reefs and islets and the narrow limits of its deep-water passage.

Climate, etc. The climate is tropical, the extreme range of temperature in Zanzibar being from 60° to 98° F. Pemba is somewhat cooler. January and March are the hottest months. From November to December (or January) is the major season of rain; March to May is the minor rainy season. The mean annual rainfall in Zanzibar is roughly 60 inches, and in Pemba about 80 inches.

Dysentery, tuberculosis, venereal diseases, and leprosy are among the commonest complaints; and although there is a tendency towards decline in certain diseases through the application of preventive medicine and European principles of sanitation, it cannot be said that Zanzibar is a "white man's country."

Production. In Pemba the higher ridges are devoted to cloves and palms, and the valleys, flooded by torrential streams during the wet seasons, are tilled for rice. Cloves form the chief export of Zanzibar. Coco-nuts rank second among products, and the bulk of the copra is taken by France. As Zanzibar depends on her customs duties for over 55 per cent of her income, the high export duty on cloves is an invaluable asset, and since nearly all the world's cloves come from the Protectorate, competition is negligible. India and Great Britain are the best customers. Fisheries along the coasts are of some importance.

People. The population is mainly Swahili, and the Swahili (Bantu-Arabic) tongue is the lingua franca; but Indian traders and others form a large colony, and there are also Sinhalese, Goanese, African negro-people, Malagasies, and Arabs, the latter, of Omanese descent, forming the upper class of plantation-owners.

History. Zanzibar is mainly Mahommedan. The Swahili are Shafi Sunnites, although they have also many pagan superstitions, and the royal family belong to the Ibadhi sect, an unorthodox school founded in Oman during A.D. 744 and count-

ing the Imâms of Oman among its staunchest adherents. Their religious differences have never apparently given rise to squabbles between the Sultan and the people.

In 1890, by the cession of Heligoland to Germany and the abandonment of Madagascar to France, Britain secured her protectorate over the islands of Zanzibar and Pemba, a British Government being constituted in 1891. In the same year the mainland part of the sultanate was divided between Britain (who still pays an annual rent) and Italy and Germany (who subsequently purchased their portions).

The British part became the Kenya Protectorate in 1920. After 1906, however, the Imperial Government took a great interest in the Protectorate, which is now governed by the Sultan under the advice of a British Resident. Since 1926 there have been Executive and Legislative Councils, the former under the presidency of the Sultan, the latter of the President.

ZANZIBAR. The capital of the Protectorate of Zanzibar, on the west coast of Zanzibar Island; served by light Government railway to Bububu (7 miles). It is a great exchange depot, where merchandise coming from the East Africa mainland is forwarded to India, Arabia, Great Britain, France, etc., and has been assisted in maintaining its economic importance by its magnificent harbour, where all the East African vessels call. Loading and discharge are done by lighters, although there are several piers.

Owing to the development of the East Africa hinterland, and the consequent rise of new ports and the development of old ones, the importance of Zanzibar tends always towards decline. Pop. 45,276.

ZARA. A seaport of Dalmatia, Italy, on the Adriatic. Its chief industry is the preparation of the liqueur maraschino. Zara was assigned to Italy by the Treaty of Rapallo. Pop. 18,778.

ZEA (ancient **Keos**). One of the Cyclades, in the Ægean Sea, the nearest to Attica; area, 67 sq. miles. It is fertile, producing fruit, wine, honey, and valonia. St. Nicolas (*Hagios Nikolaos*) is the port, but Zea (ancient *Iulis*) is the capital and most populous town. Valonia oaks are the chief trees, and valonia, together with barley and almonds, are the chief exports. Sheep, goats, and charcoal are also exported. There are unworked deposits of argentiferous lead, etc. Pop. 4000.

ZEALAND (Dan. *Sjaelland*). The largest of the Danish islands, separated from Sweden by The Sound and from Funen by the Great Belt; area, 2636 sq. miles. It produces large crops of cereals, and has excellent pasture. It contains the capital of Denmark, Copenhagen. Other towns are: Praestö, Körsör, Kallundborg, Kjöge (all seaports), Elsinore, Holbaek, Roskilde, and Sorö. Pop. 600,000.

ZEBRA. The *Equus zebra*, an ungulate mammal of Southern Africa, nearly as large as a horse, white, striped with numerous brownish-black bands on the head, trunk, and

Zebra

legs, except on the belly and inside of the thighs. The zebra is extremely difficult to approach, from its watchful habits and great swiftness of foot. Only in a few instances has it been domesticated. *See* DAUW; QUAGGA.

ZEBU. A ruminant of the ox tribe, the *Taurus indicus* or *Bos indicus*, called also Brahman bull. This quadruped differs from the common ox in having one, or more rarely two, humps of fat on the shoulders, and in having eighteen caudal vertebræ instead of twenty-one. It is found extensively in India, and also in China, Japan, and Africa.

ZECHARI'AH. The eleventh of the minor prophets, supposed to have been born in Babylon, and to have been in the first detachment of the exiles who returned to Jerusalem under Zerubbabel and Joshua. He began to prophesy in the second year of Darius Hystaspes, and with his senior contemporary, the prophet Haggai, contributed powerfully by his appeals to the rebuilding of the temple (Ezra, vi., 14).

ZEDEKI'AH. The last king of Judah of the line of David. He took an oath of allegiance to Nebuchadnezzar, which he afterwards broke by entering into an alliance with Egypt. Jerusalem was thereupon besieged by Nebuchadnezzar and taken (588 B.C.). Zedekiah, whose sons were killed in his presence, had his eyes put out, and was carried to Babylon, where probably he died.

ZEEBRUGGE. A town of Belgium, in the province of West Flanders; served by the Knocke-Bruges and Knocke-Ostend railways. It guards the seaward end of the canal to Bruges and has a good harbour; but it is especially remembered as the scene of some extraordinary exploits during the European War. On 8th Oct., 1914, the British 3rd Cavalry Division landed at Zeebrugge, and it was later occupied by the Germans and became a formidable submarine base, since the harbour works were not destroyed on the British retirement. The *Brussels* (Captain Fryatt's ship) was sunk by the Germans as a blockship across the fairway (June, 1916). The British naval action of 22nd-23rd April, 1918, is described under EUROPEAN WAR (section *Last Year of Naval War*).

ZEELAND. The most westerly province of the Netherlands; it has the greater part of its surface below the sea-level, and is protected by dikes. Wheat, flax, and hemp are raised, and much dairy produce is exported. The capital is Middelburg. Area, 690 sq. miles; pop. (1931), 247,938.

ZEEMAN EFFECT. In spectroscopy, the resolution of a spectral line into components, when the source of light is placed in a magnetic field. In the simplest case, when the light is viewed along the magnetic lines of force, the spectral line is replaced by two lines, which are circularly polarised in opposite directions; but when the view is at right angles to the field, the resolution is into three lines, all plane polarised.—Cf. F. B. Pidduck, *Treatise on Electricity*.

ZEIST. A town of the Netherlands, in the province of Utrecht; served by the Utrecht-Arnhem railway. Porcelain, soap, etc., are made. Pop. (1932), 25,327.

ZEITZ. A town of Prussia, in the province of Saxony. Industries include brewing, cotton-spinning, calico-printing, and the making of soaps, perfumes, pianos, and wooden goods. Pop. 34,590.

ZEND-AVESTA. The collective name applied to the sacred writings of the Parsees, or Guebers, reverenced as a Bible, prayer-book, and sole rule of faith and practice. The writings comprehended in the *Zend-Avesta* were of vast extent, but comparatively small fragments of them now remain. They were written originally in Zend, then translated into Pahlavi, and afterwards into Parsee, or Pazend. The work, attributed in part to Zoroaster, was arranged probably at the beginning of the third century A.D. It partly consists of *Gâthâs* or songs, some of which may contain the actual words of Zoroaster.—Cf. J. Darmesteter, *Le Zend-Avesta*.

ZENGG. A seaport-town of Croatia, Yugoslavia. Mean annual temperature, 58° F. (January, 42°; July, 77°). Pop. 6000.

ZENITH. The point of the heavens vertically above an observer's head. The direction of a plumb-line, or the normal to the surface of a liquid at rest, continued upwards, points to the zenith. If the earth were a homogeneous sphere, and did not rotate, the zenith of a place would be exactly in the straight line from the earth's centre through the place, but owing to the ellipticity and rotation, it is slightly nearer to the celestial pole. The opposite point of the celestial sphere to the zenith is termed the *nadir*. The zenith distance of a heavenly body is the arc intercepted between the body and the zenith, being the same as the co-altitude of the body.

ZENO. Byzantine emperor from A.D. 474-491, born in 426. One of the chief events of his reign, which was full of vicissitudes, was the permission given by him to Theodoric to dethrone Odoacer, which led to the establishment of the Ostrogothic kingdom in Italy.

ZENO, of Citium, in Cyprus. Founder of the Stoic school of philosophy, born about 340, died 264 B.C. Settling in Athens, he attached himself to various philosophical sects in succession, until he instituted a doctrine of his own. He taught in the Stoa, a porch adorned with the pictures of Polygnotus, whence his followers were called Stoics, and were sometimes designated "disciples of the porch." His writings are all lost. *See* STOICISM.

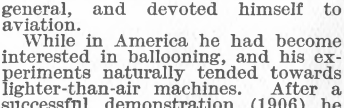
ZENO, of Elea. Early Greek philosopher, supposed to have been born about the beginning of the fifth century B.C. He taught philosophy at Athens, and Pericles is said to have been one of his pupils. He was a favourite disciple of Parmenides, and is introduced as discussing philosophy with his master in Plato's dialogue of that name.

ZENTA, or SENTA. A town of Slavonia, Yugoslavia, on the Tisa; served by rail to O-Becse. It is an agricultural centre. Pop. (1931), 32,044.

ZEOLITES. An important group of mineral silicates of aluminium, with sodium, calcium, or potassium, or all these, and various amounts of combined water. They commonly arise from the alteration of felspars, nepheline, nosean, and similar minerals, under hydrothermal influences rather than under ordinary processes of weathering. *Natrolite*, a hydrous sodium aluminium silicate, *stilbite*, a hydrous calcium sodium aluminium silicate, and *analcite*, with the same constituents as natrolite, but with less silica and water, may be cited as typical species. *Harmotome* includes barium, as celsian and hyalophane do among the felspars.

ZEPHANIAH (zef-a-nī'a). One of the minor prophets, who lived in the reign of Josiah, and who probably uttered his prophecies some time between 630 and 624 B.C.

ZEPPELIN, Count Ferdinand von. German general, born 1838, died 8th March, 1917. From the Stuttgart Polytechnic and the Military School at Ludwigsburg he passed to the army (1858), and served with the Federal forces in the American Civil War (1863), as well as in the Austrian War (1866) and the war of 1870-1.



Zeppelin

In 1890 he retired with the rank of general, and devoted himself to aviation.

While in America he had become interested in ballooning, and his experiments naturally tended towards lighter-than-air machines. After a successful demonstration (1906) he interested the Kaiser, who made it his business to encourage Zeppelin, and the result of his patronage was the first Zeppelin airship (1909).

Zeppelin's primary idea was the construction of an airship to accompany armies and war-vessels for observation purposes, and to carry mails and passengers from point to point. A national Zeppelin fund was raised, and Friedrichshafen, on Lake Constance, became a hive of industry.

The rigid type of airship was brought almost to perfection by Zeppelin and his associates, and was used with great effect during the European War, the Allies copying the German construction and ultimately, in post-war ships of the "R" type, even surpassing them in many ways.

ZERBST. A town of Anhalt, Germany; served by the Magdeburg-Leipzig railway. It was once famous for beer, and has a brewery, iron-foundry, machine-shops, and manufactures of gold and silver lace. Pop. (1925), 19,471.

ZERMATT. A tourist-resort (5320 feet altitude) of Switzerland, canton Valais; served by rail from Visp. It is the jumping-off place for the Matterhorn. Pop. 800.

ZERZURA. Oasis in the Libyan Desert. Long regarded as a lost land, it was discovered by an expedition in April, 1932. It is some 300 miles to the west of Wadi Halfa on the Nile.

ZEUGLODON (zū'glo-don). An extinct genus of whales, in which anterior conical teeth and flattened notched molar teeth were retained in both jaws. They belong to the Eocene and Miocene, and *Z. cetoides* of the Middle Eocene of the United States attained a length of 70 feet.

ZEULENRODA. An industrial town of Thuringia, Germany, in Reuss; served by the Werdau-Mehltheuer railway. Pop. 10,000.

ZEUS (zūs). In Greek mythology, the supreme divinity; the ruler of the other gods; generally treated as the equivalent of the Roman Jupiter. He was the son of Cronos and Rhea, brother of Poseidon (Neptune) and Hera (Juno), the latter of whom was also his wife. He expelled his father and the dynasty of the Titans, successfully opposed the attacks of the giants and the conspiracies of the other gods, and became chief power in heaven and earth. *See* JUPITER.

ZEUXIS. Greek painter, who flourished about 420-400 B.C., and spent his latter days at Ephesus. He belonged to the Asiatic school of painting, the distinguishing characters of which were accurate imitation and the representation of physical beauty.

ZHITOMIR (Pol. *Zytomierz*). A town of Russia, capital of the district of Volhynia, Ukraine, on the Teterev. Pop. 77,000.

ZIBET, or ZIBETH (zib'et), *Viverra zibetha*, or Indian civet, an animal of the same genus as the African civet-cat. It is found in Eastern Asia, and in some of the larger islands of the Indian Archipelago. It secretes an odoriferous substance which resembles that of the civet.

ZIMBAB'WE. A group of ruins in Southern Rhodesia, 17 miles south of Victoria. There are two principal structures: a kind of citadel on the

crest of a granite hill, and an elliptical enclosure with granite walls on the lower level ground. The latter is divided into chambers, most of which are roofed, and contains two conical solid towers. The ruins are not generally supposed to be very ancient, but their origin is quite unknown. Smaller ruins of similar nature are found elsewhere in Southern Rhodesia and the Transvaal.

ZIMNICEA. A Rumanian river-port, on the Danube opposite Svishtov; the terminus of a railway from Costesci. It has a shipping trade. Pop. 12,000.

ZIMONY. The Magyar name for an important commercial town of Slavonia, Yugoslavia, on the Danube at the disemboguing of the Save; served by rail to Budapest and Belgrade. Pop. 18,000.

ZINC. One of the common metals (symbol, Zn; atomic weight, 65·37). Commercially it is known as *spelter*. It has a bluish-white colour, a high metallic lustre, and a crystalline texture. Its specific gravity is about 7; it is relatively hard, and at the ordinary temperatures brittle; between 100° and 150° C. it becomes softer, and can then be rolled into foil or drawn into wire, and then retains its malleability; but at 200° it is again very brittle. It melts at 419° C., and when slowly cooled crystallises in four- or six-sided prisms.

Zinc undergoes little change by the action of air and moisture. When fused in open vessels it absorbs oxygen, and forms the white oxide called *flowers of zinc*. Heated strongly in air, it takes fire and burns with a beautiful white light, forming oxide of zinc. Zinc is found in Germany, the United States, France, Italy, Belgium, Spain, Sweden, etc. It does not occur native, but is obtained from its ores, which are chiefly the sulphide, or *zinc-blende*, and the carbonate, or *calamine*.

Important ore bodies containing sulphides of lead and zinc together with silver occur in New South Wales, Burma, Rhodesia, United States, etc. For obtaining the metal, calamine is first calcined and blende roasted; the oxide formed as a result of these operations is mixed with carbon and strongly heated in retorts; the metal is reduced and distils over, being condensed to a liquid in suitable condensers.

Recently great advances have been made in the treatment of zinc ores by roasting, solution of the zinc in sulphuric acid, purification of the solution, and electro-deposition of the metal. The oxide of zinc (ZnO) is a fine white powder, insoluble in water, but very soluble in acids, which it neutralises, being a powerful base of the same class as magnesia. It reacts with both acids and alkalis, generating hydrogen.

Commercial Uses. Several of the salts of zinc are employed in medicine and the arts; the sulphate, $ZnSO_4$, $7H_2O$, or white vitriol, is used in calico-printing, and in medicine as an astringent, a caustic, an emetic, and a tonic; the oxide and the carbonate, $ZnCO_3$, are used as pigments, etc. Sheet-zinc is largely employed for lining water-cisterns, baths, etc., for making spouts and pipes, for covering roofs, and other purposes.

Plates of this metal are used as generators of electricity in voltaic batteries, etc.; they are also employed in the production of pictures, etc., in the style of woodcuts. Zinc is much employed in the manufacture of brass and other alloys, and in preparing galvanised iron. *Zinc dust* is a fine powder of free zinc together with its oxide, and is obtained during the distillation of zinc.

ZINCOGRAPHY. An art in its essential features similar to lithography, the stone printing-surface of the latter being replaced by that of a plate of polished zinc. *See* ANASTATIC PRINTING.

ZINDER. A military centre of the French Sudan, 140 miles N.N.E. of Kano.

ZINNIA. A genus of herbs, order Compositæ, natives of North America. They are old favourites in cottage gardens on account of their gaily-coloured flowers; these approach "immortelles" in texture, and if dried in hot sand retain their form and colour for a long time.

ZINZIBERA'CEÆ, or ZINGIBERA' CEÆ. A natural order of plants, of which the genus Zinziber (ginger) is the type. The species are all tropical plants, or nearly so, the great number inhabiting various parts of the East Indies. They are chiefly valued for the sake of the aromatic and stimulating properties of the rhizome or root, found in ginger, galangal, zedoary, cardamoms, etc.

ZIONISM. The name given to a Jewish nationalist movement which aims at the establishment of the Jews in Palestine on a national basis. Those who favour this movement differ widely in their reasons for doing so. For some it is mainly an economic and philanthropic movement, for others it is religious and idealistic.

Religious Jews who are in favour of the movement believe that by establishing a Jewish home in Pales-

tine, Judaism, or the Jewish religion, will be safeguarded, and Israel will be saved from assimilation. Jewish agnostics and free-thinkers, on the other hand, support Zionism because they are convinced that only in Palestine, in their national home, will the Jews be able to maintain their national unity without requiring the bonds of religion.

For these, as indeed for the majority of Zionists, Zionism is first and foremost a national movement, independent of religion, which is the private concern of the individual. If some Zionists, even unbelievers, frequently observe religious ceremonies, their actions are no doubt the result of diplomacy.

Jewish *intellectuals* see in the movement an opportunity to develop the national genius of Israel in the historic land; they cherish the dream of giving mankind a new and brilliant civilisation. Jewish Socialists, on the other hand, are attracted by the social and economic possibilities latent in Zionism. They foresee the creation of a new state of society, of a social and economic régime based not on capitalism, but on democracy and socialisation. Not only numerous Jews, but also a good many Christians, and particularly Anti-Semites, are in favour of the movement, the latter rejoicing in the hope of getting rid of the Jews in a not dim and distant future.

Among the opponents of Zionism are not only the reformed Jews, but also the ultra-orthodox Jews. The reformed Jews deny to Israel the name of nation in a political sense, and consider the Jews as a religious community. Israel's future lies among and is intimately connected with the destinies of the nations in whose midst Jews dwell. Zion is only a symbol, and the national ideal of Judaism is to oppose the idea of nationalism. Judaism is progressive and evolutionary, and even in its first national establishment it contained the seeds of universalism which were destined to blossom forth and bear fruit in the ages to come.

Ultra-orthodox Jews, on the other hand, look upon the movement of Zionism as forcing the hand of Providence. For them the Restoration is a religious hope, connected with the coming of the Messiah, who would overthrow the hostile powers, restore the temple and its worship, and inaugurate a Messianic reign. These Jews, therefore, will have nothing to do with a Jewish national movement divested of and frequently hostile to the Jewish religion.

History. Ever since their dispersion, the Jews (q.v.) have entertained the hope of returning to Zion, or Palestine, and several attempts have been made to bring them to the Holy Land. It was, however, during the nineteenth century, when the national movement among the European nations became more intense (especially after 1859), that Zionism received a new stimulus.

The nineteenth century witnessed also the revival of Jewish race-consciousness and national feeling, sentiments strengthened by Anti-Semitism and oppression. Moses Hess published his *Rom und Jerusalem* (1862), and Leo Pinsker his *Autoemancipation* (1882). The result was the movement of the *Chovevei Zion* (or Lovers of Zion), which inaugurated colonisation in Palestine for the purpose of ultimately reviving the Jewish people on their historic soil.

It was, however, only in 1896 that political Zionism was founded by Theodor Herzl (q.v.), who published his pamphlet *Der Judenstaat* and advocated an autonomous Jewish state, preferably in Palestine. Herzl enlisted the sympathies of many Jews, and a Zionist Congress was convened at Basel, Switzerland, on 29th Aug., 1897. Here the Zionist political programme was adopted, and its purpose was "to establish for the Jewish people a publicly recognised, legally assured home in Palestine."

Great Britain always took an interest in Zionism, and in 1903 the British Government made an offer of land in British East Africa, but the offer was declined by the Zionist organisation.

On 2nd Nov., 1917, Mr. A. J. Balfour informed Lord Rothschild that "the British Government viewed with favour the establishment of a Jewish national home in Palestine," and would use their best endeavours to facilitate the achievement of this object.

The words "national home" have never been clearly defined. The Zionists maintain that "national home" means the ultimate establishment in Palestine of an autonomous Jewish commonwealth. Mr. Churchill, however, when Colonial Secretary, defined the words "national home" in the sense of granting to the Jews the right of establishing colonies, educational, cultural, and industrial institutions in Palestine, "as far as the present inhabitants of the country (Arabs) will allow" (see *Jewish Chronicle*, Aug., 1922).

The Balfour Declaration was hailed with great enthusiasm by Jews all over the world. Zionists now set to work to claim, in the name of the Jewish people, the granting of the mandate over Palestine to Great

Britain. Their proposals were submitted to the Peace Conference in Paris on 3rd Feb., 1919, and were accepted at San Remo on 28th April, 1920.

In 1921 a National Home for the Jews was actually set up. A fund (the Jewish National Fund) was instituted for the purchase of land in Palestine, another (the Keren Heysod) for general colonisation purposes. With the Zionist organisation was allied the Jewish Agency, in which Zionists were associated with non-Zionists in the nationalist movement.

From that time the power and prestige of the Jews in Palestine has steadily increased, though in 1929 there was some rioting arising from a dispute with the Arabs over the possession of the Wailing Wall at Jerusalem.

In 1933 the Green Cross Society inaugurated a scheme for the extensive planting of trees in the Holy Land, to aid in the material and æsthetic development of the country. *See* PALESTINE.—BIBLIOGRAPHY: N. Sokolow, *History of Zionism*; M. Bernfeld, *Le Sionisme*; T. Herzl, *Zionistische Schriften*; M. Nordau, *Zionistische Schriften*; P. Horowitz, *The Jewish Question and Zionism* (1927); J. H. Haynes, *Palestine To-day and To-morrow* (1930).

ZIRCON. A hard gem-like mineral crystallising in the tetragonal system, and composed of zirconium silicate, $ZrSiO_4$. It is isomorphous with cassiterite, rutile, and thorite. It occurs frequently in igneous rocks rich in sodium, and is very common as minute crystals enclosed in the micas and other minerals of granite. The name comes from the Arabic *zargun*; *jargon*, a colourless to smoky zircon of Ceylon, and the red variety *hyacinth*, are known as gems.

ZIRCONIUM. The metal contained in zircon and certain other rare minerals; symbol, Zr; atomic weight, 90·6. It is closely related to titanium and silicon.

ZIRKNITZ, or **CZIRKNICZ.** A lake of Italy, in Carniola, 30 miles E.N.E. of Trieste, about 5 miles long and between 2 and 3 miles broad.

ZIRYANSK. *See* RUSSIA (table).

ZISKA, John. Leader of the Hussites, born about 1360, died 1424. He joined as a volunteer the Knights of the Teutonic Order, and fought against the Poles, as also with the Hungarians against the Turks. He is also said to have fought on the English side at the battle of Agincourt. Returning to Bohemia, he became the leader of the Hussites; established himself at Mount Tabor, which he fortified, and where a town grew up occupied by his followers, who thence subsequently took the name of Taborites. His forces achieved the most signal successes by defeating a powerful army of Imperialists at Deutschbrod. While engaged in the siege of Przibislaw he was carried off by the plague.

ZITHER. This instrument, which is very popular in the Tyrol and Bavaria, consists of a resonant box over which are stretched a number of strings, some of gut and the remainder of wire. The number of strings varies, and may be as high as forty-two. Five of these strings, those lying nearest to the performer, are stretched over frets and are tuned in fifths, the two highest both being tuned to A on the treble stave.

On these five strings the melody is played, the performer stopping the wires with the fingers of the left hand by means of the frets, which are at distances of a semitone, and plucking them with a ring-plectrum worn on the thumb of the right hand. The fingers of this hand, excepting the little finger, are used to produce three-note harmonies from the remaining strings, which are arranged in a peculiar order as regards pitch, but one well fitted for the easy production of the required chords.

The music of the zither has an agreeable plaintive quality of tone.

ZITTAU. An industrial town of Saxony, on the Mandau; served by rail to Reichenberg, Löbau, etc. It stands on the fringe of a lignite-field, and has an important textile industry. Pop. 38,353.

ZLATOUST. A town of Soviet Russia, in the Ural area. It has an observatory. Mean annual temperature, 33° F. (January, 2°; July, 62°); rainfall, 18 inches. Pop. 22,000.

ZNOJMO (Ger. *Znaim*). A town of Southern Moravia, Czechoslovakia, on the Thaya; served by rail to Grusbach, and on the Vienna-Swětla (Tetschen) railway. Leather, sweets, beer, etc., are made. Pop. (1930), 25,832.

ZOAN. The *Tanis* of the Greeks and Romans, an ancient Egyptian city, on the right bank of what was the Tanitic bank of the Nile, now only a canal. It was probably the residence of the Pharaoh of the Exodus, and consequently the scene of the "marvellous things" that were done "in the field of Zoan" (Ps. lxxviii, 12). The temple was one of the grandest in Egypt. Its ruins, buried under mounds, have been explored, and one of the chief curiosities found in them is the

Canopus stone, with a trilingual inscription, like that on the Rosetta stone, hieroglyphic, demotic, and Greek, recording a decree of Egyptian princes assembled at Canopus 254 B.C.

ZOANTHA'RIA. An order of the class Anthozoa, represented by the sea-anemones and by the majority of corals.

ZO'DIAC. An imaginary belt or zone in the heavens, extending about 9° on each side of the ecliptic. It is divided into twelve equal parts called signs. The designation "zodiac" was given from the fact that all the twelve constellations occupying the several signs, except Libra, the Balance, had been named after animate beings. Owing to the precession of the equinoxes, the signs have now parted from their original constellations. The twelve signs of the zodiac are: Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Agnarius, and Pisces.

The zodiac was marked out by the ancients as distinct from the rest of the heavens because the apparent places of the sun, moon, and the planets known to them were always within it. Many of the minor planets, however, pass at times considerably outside of its limits.

ZODIACAL LIGHT. In astronomy, a band of faint light seen in the sky, having its widest part on the horizon, and tapering gradually away to an apex. Its medial line or axes lies nearly along the ecliptic. It is often more brilliant than the Milky Way, but cannot, like it, be observed upon a perfectly dark sky. It is most easily seen in tropical regions. Elsewhere it is best seen in the west after sunset in spring, or in the east before sunrise in autumn.

It appears to be due to the reflection of the sun's light by myriads of small particles scattered in and near the plane of the ecliptic. Some of this meteoric dust must extend beyond the earth's orbit, for the light has not only been traced to more than 90° from the sun, but in tropical regions even right round the sky.

It becomes fainter and fainter with increasing angular distance from the sun, until at the point opposite the sun's position there is formed a somewhat brighter patch, called the "gegenschein," or counter-glow. The zodiacal light may be regarded as an appendage of the sun, doubtless continuous with the corona, but differing much from it in constitution.

ZOISITE. A colourless or brownish mineral silicate of aluminium and calcium with some hydrogen, differing from epidote in containing no iron. The crystals closely resemble those of epidote, but have orthorhombic symmetry. Zoisite is a common product of the subterranean decomposition of calcium felspars.

ZOLA, Émile. French novelist, born 1840, died 1902. He first became generally known by commencing, in 1871, the series of novels entitled *Les Rougon-Macquart, Histoire Naturelle et Sociale d'une Famille sous le Second Empire.* One of the series, *L'Assommoir*, portraying the evil consequences of drunkenness, was dramatised by Charles Reade as *Drink*, and became popular. Among Zola's other novels are: *Nana, Germinal, L'Œuvre, La Terre, La Bête Humaine, La Débâcle, Dr. Pascal, Lourdes, Rome, Paris,* and *Fécondité. See* DREYFUS.—Cf. E. A. Vizetelly, *Zola, Novelist and Reformer.*

ZOLLVEREIN (tsol'fêr-în). A certain form of Customs Union, especially that in force among the German states between 1819 and 1871. The Zollverein did much to prepare the way for the establishment of the late German Empire. It was extended mainly through the efforts of the Government of Prussia. Its principal object was the establishment of a uniform rate of customs duties throughout the various states joining the Union.

ZOMBA. The capital of Nyasaland, on the northern slope of Mount Zomba, in the Shiré Highlands. The mean annual temperature (3000 feet altitude) is 68·5° F. (July, 60·6°; November, 74·5°), and the rainfall 54·2 inches (11·3 inches in January). From November to April is the rainiest season. Blantyre, also at the 3000-feet level, has a mean annual temperature of 68° F. White pop. *c.* 170.

ZOMBOR. The Magyar form of the Serbian *Sombor*, a town of Slavonia, Yugoslavia; served by the Baja-Neusatz (Ujvidek) and Szabadka (Theresiopel)-Dalj railways. Matches are made, and the grain trade is large. Pop. (1931) 32,256.

ZONE. (1) In geography, one of the five great divisions of the earth, bounded by circles parallel to the equator, and named according to the temperature prevailing in each. They are: (*a*) the *torrid zone*, extending from tropic to tropic, or 23½° north and 23½° south of the equator; (*b*) two *temperate zones*, situated between the tropics and polar circles, or extending from the parallel of 23½° to that of 66½° north and south, and therefore called the north temperate

and south temperate zone respectively and (*c*) two *frigid zones*, situated between the polar circles and the north and south poles (*see* CLIMATE).

(2) In natural history, the name is given to any well-defined belt within which certain forms of plant or animal life are confined; as the different belts of vegetation which characterise the various altitudes on the sides of a mountain.

ZOOLOGICAL GARDEN. A public garden in which a collection of animals is kept. The gardens of the Zoological Society, Regent's Park, London (familiarly termed "the Zoo"), founded in 1828, are probably the finest of the kind in the world. They belong to the Zoological Society of London, which was founded in 1826, among its promoters being Sir Humphry Davy and Sir Stamford Raffles. Of the other chief zoological gardens, the Jardin des Plantes in Paris is the oldest, having been founded in 1794.

ZOOLOGY. The science which deals with the animal kingdom. Among early workers in *systematic* zoology Gesner and Ray deserve mention, but the science in its present form practically began with Linnæus (1758), who introduced the practice of specifying an animal by two Latin or quasi-Latin words, the first denoting the *genus* and the second the *species*. Linnæus divided all animals into six *classes*, Mammalia, Aves, Amphibia, Pisces, Insecta, and Vermes. Each class was subdivided into *orders* and each order into *genera*.

The number of classes was increased to sixteen by Lamarck. Cuvier (q.v.) based classification on anatomy. Since Darwin's time the idea of evolution has had a paramount influence on zoological theory. Other distinguished zoologists were Von Baer, Johann Müller, Owen, Milne-Edwards, Von Siebold, Leuckart, Agassiz, Huxley, Haeckel, Fritz Müller, Dohrn, and Ray Lankester.

The names of the standard groupings now generally adopted are *phylum*, *class*, *order*, *family*, *genus*, and *species*. The phyla are divided into classes, the classes into orders, and and so on down the list. It is sometimes convenient to make a minuter analysis, a family, e.g., being divided into sub-families, and a species into varieties, races, or breeds.

The classification followed in this encyclopedia will be readily understood on reference to the articles on *Vertebrata* and *Invertebrata*, in which each of these great phyla is divided into sub-phyla, and each subphylum into classes. Separate articles are given to the chief classes, orders, and genera, under either their technical or their popular names. As an example of nomenclature, the skylark (*Alauda arvensis*) may be described as of species Arvensis, genus Alauda, family Alaudidæ, order Passeriformes, class Aves, sub-phylum Craniata, phylum Vertebrata.

Reference may be made to such articles as ENTOMOLOGY; ICHTHYOLOGY; ORNITHOLOGY; ANIMAL; ANATOMY; BIOLOGY; CYTOLOGY; HISTOLOGY; PHYSIOLOGY; FOSSILS; PALÆONTOLOGY; GEOGRAPHY (*Distribution of Animals*); PLANKTON AND NEKTON; MAN; EVOLUTION; HEREDITY; HYBRID; LAMARCKISM; MENDELISM; NATURAL SELECTION; SEXUAL SELECTION.

ZOOPHYTE (zō'o-fit; Gr. *zoon*, an animal, and *phyton*, a plant), The name given by Cuvier to any member of his sub-kingdom Radiata. It is now loosely applied to animals of extremely low organisation which present many external resemblances to plants, such as the hydroid zoophates of the class Hydrozoa.

ZOOSPORE (zō'os-pōr). A spore occurring in cryptogamic plants, which, having cilia or long filiform moving processes projecting from its surface, moves spontaneously for a short time after being discharged from the spore-case of the parent plant.

ZOROASTRIANISM. A religion of ancient Persia, called after its prophet or founder Zoroaster (*Zarathustra*, Pers. *Zerdusht*). It is also known as *Mazdaism* from its supreme god, *Magism* from its ancient priests, and *Parsism* from its modern adherents.

The facts of Zoroaster's life are completely obscured by legend, and later tradition has surrounded even his birth with marvels. When his religion was fully established, he was almost worshipped as divine, being considered as above the archangels and next to God. His history was already legendary in the time of Aristotle, who placed him 6000 years before Plato; others have supposed him to be contemporary with Moses. Modern researches place his birth about 660 B.C., or perhaps several centuries earlier.

The Zoroastrian Bible is the *Avesta* or *Zend-Avesta*, but only that portion called the *Gâthâs*, or versified preachings, is the work of the prophet. Zoroaster combined in a metaphysical and ethical system elements which he found around him, transmitted in the teaching of the sages of India and Iran.

Both his metaphysics and ethics are based on the idea of dualism, and the warfare between the good and

evil principles. Zoroaster imagined two principles which exist in all things, and are respectively the causes of all good and evil. These he called the *Vohu Mano*, or good mind, and the *Ahem Mano*, or evil mind. These primal spirits revealed themselves in vision as twins, and though opposed are inseparable, being apparently the necessary opposites of each other. The one creates day and the other night; the former produces life, and the latter extinguishes it. These two minds exist in Ahura Mazda as well as in all created things.

Subsequent interpreters of Zoroastrianism developed these two principles into two distinct and powerful beings, Ormuzd and Ahriman, the good and evil spirits, the Better and the Bad in thought, word, and action. Ahura Mazda or Ormuzd created the world and rules it, but Ahriman, his spiritual enemy or devil, invaded the world and created disorder.

Thus nature is divided, but man is a free agent; and by choosing right and obeying the law, by thinking good thoughts, speaking good words, and performing good deeds, he will help to bring about the ultimate victory and triumph of the good spirit, Ahura Mazda, and the annihilation of evil.

Among the doctrines of Zoroastrianism are a distinction of a natural and spiritual life, a belief in immortality, resurrection of the body, the coming of a Messiah, and a final judgment. There are numerous resemblances with Judaism and Christianity. Zoroastrianism became the State religion under the Sassanids (A.D. 226-640). *See* PARSEES.—BIBLIOGRAPHY: A. S. Wadia, *The Message of Zoroaster*; J. H. Moulton, *Early Zoroastrianism*; A. V. W. Jackson, *Zoroaster, the Prophet of Ancient Iran*.

ZOSTERA. A genus of marine herbs, order Naiadaceæ. *Z. marina* is the grass-wrack common on our coasts. It is one of the few Flowering Plants with aquatic pollination; the pollen-grains are long threads with the same specific gravity as seawater, and are thus able to float at any depth, and the stigmas are very large, as in wind-pollinated plants.

ZSCHOPAU (tsho'pou). An industrial town of Saxony, on the Zschopau; served by the Flöha-Annaberg railway. Pop. 10,000.

ZUFFENHAUSEN. A town of Württemberg; a junction on the Friedrichshafen railway for Kalw (Calw: population, 5363; on the Pforzheim-Horb railway). It manufactures leather, wire, and iron goods. Pop. 13,000.

ZUG. A central and the smallest undivided canton of Switzerland. The surface, mountainous in the south-east and south, where the Rossberg occupies the frontier, slopes more or less gradually north and west, till it becomes comparatively flat. Zug and Egeri are the chief lakes. The climate, rigorous in the mountainous districts, is mild on the lower south slopes. The chief exports are cattle, fruits, cider, and "kirschwasser." Zug is the capital. Cham (pop. 4000), centre of the Anglo-Swiss Condensed Milk Company, on the Zug-Lucerne railway, and Baar (pop. 5000) are other places. Area, 92 sq. miles; pop. (1930), 34,395 (mainly German-speaking Roman Catholics).

ZUG. A town of Switzerland, capital of canton Zug, on the Lake of Zug; served by the Zürich-Lucerne railway. Tobaccos, cottons, and soap are manufactured. Pop. 11,155.

ZUG, LAKE OF, or **ZUGERSEE.** A lake of Switzerland, in the canton of Zug, 9 miles long north to south; area 14 sq. miles. The fishing, principally pike and carp, is productive.

ZUIDER (or **ZUYDER**) **ZEE** (zoi'dêr-zā; "South Sea"). A gulf of the North Sea, on the coast of Holland; 80 miles long, 40 miles greatest breadth. It was formerly a lake, but was united with the North Sea by inundations in the twelfth and thirteenth centuries. The islands Texel, Vlieland, Terschelling, Ameland, etc., separate it from the North Sea, with which it communicates by various channels, the principal being Hellsdeur (Hell-gate), between the Helder and Texel. It is very shallow, and to avoid the difficulties of its navigation to Amsterdam the North Holland Canal was constructed. In 1920 a scheme for the reclamation of 500,000 acres was started. This involved the building of a dam or dyke, nearly 20 miles long, across the entrance from North Holland to Friesland, utilising the Island of Wieringen. In May, 1932, the dam was completed and some 800 sq. miles were reclaimed.

ZULIA. A state of Venezuela, comprising mainly a great lake-studded and partly forested plain fringing the shores of Lake Maracaibo, and traversed by anastomosing rivers (Negro, Zulia, Catatumbo, etc.) disemboguing to the lake. Cacao, coconut, sugar, coffee, and cotton are raised. Maracaibo (q.v.) is the capital. Area, 24,950 sq. miles; pop. 222,613.

ZU'LULAND. A South African territory forming the north-eastern

region of Natal. The Tugela is the southern boundary; on the north it has Tongaland, on the east the Indian Ocean. The southern portion of the country consists chiefly of undulating plains, covered with grass, and thinly wooded. The coast region is flat, marshy, and very unhealthy, but is largely covered by sugar-plantations, especially along the Umfolosi river-valley. The inland region is healthy and rich in tropical productions.

History. The Zulus are a warlike Kaffir tribe, and for a time were formidable to the colonists of Natal, possessing an organised army of considerable numbers. in 1879, under their king Cetewayo (q.v.), they came into conflict with the British. At first the war was unfortunate for the British (a body of troops having been annihilated at Isandula), but in July, 1879, a general engagement took place at Ulundi, where the power of the Zulus was quite crushed.

The subsequent British reorganisation of Zululand did not work successfully, and in 1882 Cetewayo was restored, a strip of country adjacent to Natal being constituted a "reserve." Into this reserve Cetewayo fled in 1883, after being defeated by a hostile Zulu chief, Usibepu, and there he died in 1884. However, Cetewayo's son Dinizulu, assisted by Transvaal Boers, vanquished Usibepu, and drove him into the reserve.

Ultimately the Boers took possession of a considerable portion of the country, while the remaining portion of Zululand, with the reserve, was (1887) annexed by Britain and (1897) incorporated with Natal, of which it now forms a "province."

Productions. Maize and other cereals are raised, and cattle-breeding is progressive. The holding of land by Europeans is not permitted, except for missionary, trading, or mining purposes. The minerals are valuable, and include gold and coal.

Eshowe is one of the chief centres and is reached by a branch of the Durban coast railway from Gninhlovu. There are asbestos-mines near Eshowe. The Durban line ends at Somkele, lying in a marshy and malarial peneplain, the centre of the Hlabisa (or Santa Lucia) coal-field. Area, 10,427 sq. miles; pop. about 202,000. *See* TONGALAND.

ZÜRICH. A canton of Switzerland, one of the northern cantons, extending from the Lake of Zürich to the Rhine, to which its waters are carried by the Thur, Töss, Glatt, and Limmat. It is highly cultivated. There are extensive manufactures of silk and cotton goods. Area, 667 sq. miles; pop. (1930), 617,706 (mainly German-speaking Protestants).

ZÜRICH (ancient **Turicum**). A city of Switzerland, capital of canton Zürich, at the northern end of the Lake of Zürich, on the Limmat, and having on the west the Sihl, which joins it immediately below; a railway centre with steamer services on the lake. The chief industry is that of silk, but cotton-spinning and the manufacture of locomotives and machinery are important. Pop. (1930), 249,820.

ZÜRICH, LAKE OF, or **ZURICH-SEE.** A lake of Switzerland, lying chiefly in the canton of Zürich, but partly in Schwyz. Its greatest length is about 27 miles; area, 33 sq. miles The chief feeder is the Linth Canal, communicating with the Wallenstatter-see. It discharges itself at the town of Zürich by the Limmat.

ZUTPHEN. A town of the Netherlands, in the province of Gelderland. It has an active trade, especially in timber and grain, and is notable as being the place where Sir Philip Sydney was mortally wounded in 1586. Pop. 19,586.

ZWEIBRÜCKEN (Lat. *Bipontium*; Fr. *Deux-Ponts*, two-bridges). A town of Bavaria, on the Schwarzbach; served by rail to Sarreguemines, Landau, Homburg, and St. Ingbert. Manufactures include velvet, plush, and cotton fabrics. The edition of the classics known by the name of "Bipont" was published there. Pop. 15,783.

ZWEISIMMEN. A town of Switzerland, in canton Bern and in the Upper Simmental; the junction for Lenk (8 miles) on the Montreux-Spiez railway. It is noted for cattle, and is a tourist centre specialising in winter sports. Pop. 5000.

ZWICKAU (tsvik'ou). An industrial town of Saxony, the centre of the Erzgebirge coal-mining zone; served by rail to Ölsnitz, Chemnitz, Werdau, and Reichenbach. Manufactures include linen and cotton goods, dyes, and chemical products. Pop. (1925), 80,358.

ZWINGLI, or (as it is often latinised) **ZUINGLIUS, Ulrich.** The Swiss reformer, born 1st Jan., 1484, in the canton of St. Gall, died 11th Oct., 1531. Intended for the Church, he studied at various places, during a second residence at Basel becoming the pupil and friend of Thomas Wyttenbach, a reformer before the Reformation, and from him learned the evangelical doctrines which he afterwards promulgated with signal success.

His first overt revolt against the Roman Catholic system was when he was a priest at Einsielden (1516), which a supposed miracle-working image of the Virgin had made a favourite resort of pilgrims. He denounced the superstition of pilgrimages so effectively that his sermons were talked of in Rome, and it is said futile offers of promotion were made to bribe him into silence. In 1518 he was appointed preacher in the cathedral of Zürich, where he denounced and baffled a vendor of indulgences.

Then followed other denunciations of Roman Catholic practices and doctrines, until Zürich, the authorities of which supported Zwingli, and the people of which adhered to him, became thoroughly Protestant, and adopted a reformed theology, worship, and discipline. Zwingli went further than Luther, whose doctrine of con-substantiation led to what proved on the whole a resultless conference on the subject between him and Luther and Melanchthon at Marburg in 1528. In 1531 the Forest Cantons, which adhered to the Roman Catholic faith, made war upon Zürich, whose troops Zwingli accompanied as chaplain. While in the thick of an engagement at Kappel, near Zürich, he was mortally wounded —Cf. Samuel Simpson, *Life of Ulrich Zwingli, the Swiss Patriot and Reformer.*

ZWITTAU (Czech. *Svitava*). A town of Moravia, Czechoslovakia; the junction for Skutsch on the Vienna-Prague trunk line. Linen, jute, silk, cotton, and beer are made. Pop. 10,000.

ZWOLLE (zwol'lĕ). A town of the Netherlands, capital of the province of Overyssel; served by the Zutphen-Leeuwarden, Almelo-Zwolle, and Utrecht-Kampen railways. Oil-, grain-, and saw-milling are important, as is the trade in grain, cattle, and fish. Pop. (1932) 41,043.

ZYGOMORPHIC FLOWERS. Those flowers which are divisible into equal halves in a single plane only, as those of sweet-pea, snap-dragon, orchids, etc. Such flowers are adapted for cross-pollination by the larger and more intelligent insects, such as humble-bees. Also termed irregular flowers.

ZYGOMYCETES. That group of the Lower Fungi or Phycomycetes in which sexual reproduction is carried out by the fusion of similar gametes. Representative genera: Mucor; Pilobolus; Empusa. *See* ENTOMOPHTHORINEÆ.

ZYGOPTEREÆ. A family of extinct (Palæozoic) Ferns. Together with the Botryoptereæ, likewise extinct, it forms the group of Cœnopterideæ, comprising the most primitive of known ferns.

ZYGOSPORE. In botany, a spore produced by the fusion of two similar gametes, as in Conjugatæ and Zygomycetes. Opposed to oöspore (q.v.).

ZYGOTE. In botany, the general term for any cell produced by the fusion of gametes; the immediate product of sexual union.

ZYMOTIC DISEASES. A name applied to epidemic and endemic contagious diseases. Owing to the development of bacteriology, the name is now little used.

ZYRIANS. A Finnish tribe which inhabits part of the governments of Perm (q.v.) and Archangel, Russia. They have to a large extent abandoned their native language and speak Russian. They number about 100,000, and live for the most part by means of hunting.

END OF VOLUME X

Printed by H. Henderson at the Villafield Press, Bishopbriggs